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FOR COMPONENTS ON THE SRB, ET, AND SSME
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PRELIMINARY VIBRATION, ACOUSTIC, AND SHOCK
DESIGN AND TEST CRITERIA FOR COMPONENTS
ON THE SRB, ET, AND SSME

By Systems Dynamics Laboratory

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16. ABSTRACT <p>This reports presents the vibration, acoustic and shock design and test criteria for components and subassemblies on the External Tank (ET), Solid Rocket Booster (SRB), and Space Shuttle Main Engine (SSME). Also presented are specifications for transportation, handling, and acceptance testing.</p> <p>The Space Shuttle ET, SRB, and SSME have been divided into zones and subzones. Zones are designated primarily to assist in determining the applicable specifications. A subzone (General Specification) is available for use when the location of the component is known but component design and weight are not well defined. When the location, weight, and mounting configuration of the component are known, specifications for appropriate subzone weight ranges are available. Criteria for some specific components are also presented.</p> <p>Included with the specifications are vibration, acoustic, shock, transportation, handling, and acceptance test requirements and procedures. A method of selecting applicable vibration, acoustic, and shock specifications is also included.</p>			
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PREFACE

The vibration, acoustic, and shock design and test criteria presented in this document are based on the latest SRB, ET, and SSME structural configuration and will be updated as further design information and vibroacoustic data become available.

These criteria supersede those published in document IN-ASTN-AD-73-4 dated September 3, 1973 and TM X-64868, dated September 3, 1974, and will be referenced in the Shuttle Flight and Ground System Specification, JSC07700, Volume X.

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ABBREVIATIONS

D. A. Disp.	Double Amplitude Displacement
dB	decibel
dB/oct	decibels per octave
ET	External Tank
G	unit of acceleration (32.2 feet per sec ²)
g^2/Hz	acceleration spectral density
g_{rms}	root mean square acceleration
G's peak	peak acceleration
Hz	Hertz (cycles/sec)
in.	inch
lb	pound
MSFC	Marshall Space Flight Center
sec	second
SPL	Sound Pressure Level
SRB	Solid Rocket Booster
SSME	Space Shuttle Main Engine
X_b	X-Axis of SRB
X_t	X-Axis of ET
Y_b	Y-Axis of SRB
Y_t	Y-Axis of ET
Z_b	Z-Axis of SRB
Z_t	Z-Axis of ET

SECTION I. INTRODUCTION

This document presents the vibration, acoustic, and shock design and test criteria for components and subassemblies on the External Tank (ET), Solid Rocket Booster (SRB), and Space Shuttle Main Engine (SSME). Also presented are specifications for transportation, handling, and acceptance testing. Subzones (General Specifications) are presented for all locations. Specifications are also presented for some specific components and subassemblies.

The specifications cannot provide all the information necessary for qualification testing of each individual component and subassembly. Consequently, this document must be used under the cognizance of qualified dynamics and test engineers. The originating agency, ED23, will assist in the proper use of these specifications.

SECTION II. VIBRATION AND SHOCK QUALIFICATION TEST REQUIREMENTS AND PROCEDURES

The following requirements and procedures apply only to qualification testing:

A. Specimen

The specimens will be production components in accordance with current manufacturing drawings. Supporting brackets and component attachment hardware (lines, valves, etc.) will be included in all tests to achieve dynamic similarity to actual installation. Hardware so included in the test setup is considered part of the test specimen.

B. Fixture

The fixture will support the specimen in the manner simulating actual installation. The fixture will be designed to minimize fixture response at resonances within the test frequency range.

The fixture design and specimen installation should be approved by responsible dynamics and test engineers prior to testing.

C. Test Specimen and Fixture Resonance Survey

A sinusoidal resonance survey test is recommended in the fixture and instrumentation diagnostics process and in developmental testing. The recommended sweep rate is 1 oct/min from 5 to 2000 to 5 Hz at the following amplitudes:

- 5 - 62 Hz @ 0.0050 in. D. A. Disp.
- 62 - 2000 Hz @ 1.0 G's peak

D. Test Amplitude

All component test amplitudes will be applied as inputs to the component bracketry at the interface of the bracketry and the test fixture. The inputs will be applied along each of three mutually perpendicular axes as referenced to the interface of the component and the vehicle primary structure. The control accelerometer will be mounted on the test fixture at the point where the test specimen or specimen supporting bracketry attaches to the test fixture.

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E. Test Sequence

1. External Tank and Solid Rocket Booster. The qualification testing order for the components on the ET and SRB will be:

- Acceptance Vibration Test (when required) (Section VI)
- Flight Random Vibration Test (when specified)
- Lift-off Random Vibration Test
- Boost Random Vibration Test
- Reentry Random Vibration Test (when specified)
- Vehicle Dynamics Test
- Shock Test
- Acoustic Test (when specified)
- Transportation and Handling Tests (when specified)

Acceptance testing, when required, should be completed in all three axes prior to any other qualification testing. All random vibration, vehicle dynamics, and shock testing should be completed in one axis before proceeding to the next. When shock testing is performed on separate test equipment, all vibration testing will be completed prior to shock testing.

2. Space Shuttle Main Engine. The qualification testing order for components on the SSME will be:

- Sinusoidal Sweep Test
- Random Vibration Test
- Shock Test (when specified)
- Accoustic Test (when specified)
- Transportation and Handling Tests (when specified)

Sinusoidal sweep, random vibration, and shock testing should be completed in one axis before proceeding to the next. When shock testing is performed on separate test equipment, all vibration testing will be completed prior to shock testing.

F. Functional Performance

Specimens that function in the dynamic environment will perform to their functional specifications prior to, during, and after each qualification test.

G. Random Vibration Tests

Test equipment equalization will be accomplished by either of the following methods:

- Obtaining initial equalization by using actual test specimens and reduced vibration inputs. Final equalization will then be obtained by applying short duration excitation to the specimen at the specified test amplitudes.
- Subjecting a mass simulated dummy component to the specified test inputs as in the above method. After equalization, the dummy component will be replaced by the actual component, and equalization verified by applying short duration excitation at the specified test amplitudes.

Test amplitudes and durations are provided in the applicable specifications. Test setup and equalization times should be minimized. Neither of these time durations will be considered part of the specified test duration.

H. Vehicle Dynamics Test

Test amplitudes are provided in the applicable specifications. The specified frequency spectrum will be swept logarithmically at the rate of 3 oct/min as described below:

- ET: Sweep from the low frequency to the high frequency one time in each of the vehicle axes.
- SRB: Sweep from the low frequency to the high frequency to the low frequency two times in each of the vehicle axes.

I. SSME Sinusoidal Sweep Test

Test amplitudes are provided in the applicable specification. The specified frequency spectrum will be swept logarithmically at the rate of 1 oct/min from 10 to 2000 to 10 Hz four times in each test axis.

J. Shock Test

Shock pulses or spectra are stated for each specification. When two shock criteria are specified for a component, only the maximum shock spectrum should be used. Any pulse that results in a spectrum within the test tolerances at every frequency of the specified shock spectrum is acceptable. Either mechanical or ordnance shock testing is acceptable. During mechanical shock testing, the test specimen will be subjected to two shocks per mission in each axis (equivalent to one in

each direction) for a total of six shocks per mission. During ordnance shock testing, the specimen will be subjected to one shock per mission, which must satisfy the applicable specifications in at least one axis.

K. Combined Environments

Vibration, shock, and acoustic testing under various combined environments will be specified, when required, by the responsible Marshall Space Flight Center (MSFC) organization.

L. Test Tolerances

The test spectra shall be verified by narrow band spectral analysis using an analysis system that is independent from the analyzer/equalizer used to control the test. Tolerances considered acceptable are as follows:

- Vibration

Composite Root Mean Square Acceleration	±10%
Acceleration Spectral Density (Tolerances pertain to bandwidths of 25 Hz or less)	+100% -30%
Sinusoidal Peak Acceleration	+20% -10%
Sinusoidal Control Signal Maximum Harmonic Distortion	±10%
Frequency	±5%
Test Duration	+10% -0%

- Shock Spectrum

Spectrum Peak Acceleration (When analyzed with a 1/3 octave shock spectrum analyzer and 5 percent damping.)	+40% -20%
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- Shock Pulse

Amplitude	+40% -20%
Duration	±10%
Pulse Overshoot (Water Impact)	+20%

M. Failure Determination

A specimen will be considered to have failed a particular test if the specimen malfunctions during or after the test, or if post-test prescribed inspection reveals structural damage. All test failures will be reported immediately to the originating agency (ED23).

N. Deviations From Specifications

Deviations from these specifications may be obtained only from the originating agency (ED23). All deviations will be stated in the test report.

O. Test Reports

A report will be submitted to the originating agency by the testing agency describing in detail the tests performed and the results of the tests. The report will include drawings, sketches, and photographs, showing in detail all measurement locations. The report will include all calibration and measured test levels and any other information pertinent to the acquisition, reduction, analysis, and interpretation of the test data. Equalization levels and durations will be included.

Progress reports will be provided to the originating agency as requested.

SECTION III, SELECTION OF APPLICABLE VIBRATION AND SHOCK SPECIFICATIONS FOR STRUCTURALLY MOUNTED COMPONENTS

The selection of the correct qualification specification is essential in developing confidence and reliability in the component. The following general discussion should be considered before making such a selection.

A zonal technique has been used in generating and presenting the qualification specifications. Using this technique, the Space Shuttle ET, SRB, and the SSME have been divided into zones and subzones (Figures 1 through 5) as determined by the responsible MSFC organization. Where applicable, each subzone was further divided into subzone weight ranges or major components.

Three distinct types of component and subassembly qualification specifications are presented:

- Subzones (General Specifications)
- Subzone Weight Ranges
- Specific Component Specifications

A Subzone (General Specifications) pertains to all components and subassemblies mounted on a particular type of structure. These specifications are labeled "General" because they are applicable to all components and subassemblies in that subzone. General Specifications are based on the vibration environment for all structures within the subzones. Consequently, General Specifications usually result in more severe qualification specifications than weighted specifications. General specifications should be used only when Subzone Weight Ranges and Specific Component Specifications cannot be used.

Specifications for subzone weight ranges and major components have been determined wherever practical. These specifications pertain to certain items (components, subassemblies, panels, etc.) located within a specific subzone, and may be distinguished by the absence of the notation "General Specifications" and the inclusion of a letter suffix (-A, -B, etc.) in the specification number. These specifications are based on vibration environments for various types of local structures (skin, stringer, ringframe, panels, etc.).

In general, specifications for individual components are based on the component's weight, location, and mounting configuration and can be found in the appropriate subzone. Specifications for selected SRB and ET components are included in Appendixes A, B, and C.

The appropriate qualification specification may be determined for a particular component or subassembly by the following procedure:

- Determine if a specific component specification exists; if not:
- Identify the zone in which the component or subassembly is located;
- Within this zone determine the subzone in which the particular component or subassembly is located;
- Identify the subzone specification corresponding to the weight of the component.

SECTION IV. ACOUSTIC TEST REQUIREMENTS AND PROCEDURES

A. General Requirements

All structures and components requiring acoustic testing will be subjected to either broadband reverberant field or progressive wave testing. The acoustical random noise source for either type test will have an approximate normal amplitude distribution. Reverberant field testing is preferred for both structures and components. However, structural panels as well as components may be tested using progressive wave facilities where this type of test is justified.

B. Specification Selection

A zonal technique has been used in generating and presenting the qualification specifications. Using this technique, the ET, SRB, and SSME have been divided into zones and subzones as shown in Figures 1 through 5. Acoustic test specifications for each of these general zones are provided in Section VIII.

The appropriate qualification specification can be determined by identifying the zone or subzone in which the component is located.

C. Reverberation Chamber Facilities

The test chamber will be of sufficient volume and dimensions to ensure that the insertion of the test specimen will not affect the generation and maintenance of a broadband diffuse sound field above 50 Hz. Normally, the test specimen will be suspended in the center of the test chamber with soft suspension cords. The suspension system will have a fundamental frequency of less than 25 Hz.

The sound field in the proximity of each major surface of any test specimen that will be subjected to external acoustic environments will be determined by either flush mounted microphones or microphones mounted approximately 0.25 in. from the specimen surface. These microphones may serve as the control measurements. When the placement of these microphones is not feasible or will compromise the test results, at least three microphones located in the field will serve as control measurements. These microphones will not be located in close proximity to any surface within the test chamber. The control measurements, whether flush mounted or field located, will be averaged to determine the sound field.

With the specimen in the test chamber, the sound pressure level spectrum will be shaped at a level approximately 6 dB less than the

specification. The time required to shape the spectrum will be minimized to avoid possible overstressing of the test specimen. After completion of the spectrum shaping, the sound pressure level will be increased to the specified value, and the test will commence. As an alternative to reducing the sound pressure level while shaping the spectrum, a dummy specimen may be positioned in the test chamber, and the spectrum shaped at the test level. When the spectrum shaping has been completed, the dummy specimen will be replaced by the test specimen, and the test will commence.

D. Progressive Wave Facilities

The structural panel specimens may be tested in progressive wave facilities. The test specimen will be centrally mounted in the wall of the progressive wave duct. The width of the wave duct will be of sufficient distance to ensure minimum effects on the panel response characteristics.

Components may be tested in progressive wave facilities. The specimen will be centrally located in the progressive wave duct and suspended by a system having a fundamental frequency of less than 25 Hz. The cross section of the progressive wave duct will be of sufficient area, relative to the frontal area of the test specimen, to ensure that the insertion of the test specimen will not affect the generation and maintenance of the progressive wave. The test specimen will have each major surface exposed to the sound field by orienting each major surface parallel to the progressive wave front. Each major surface will be exposed to the sound field for the full test duration.

For both types of progressive wave testing, the sound pressure level spectrum will be shaped without the test specimen in place. The uniformity of the sound field will be determined by locating at least three microphones in the proximity of the duct cross sectional plane where the test specimen will be mounted. After mounting the test specimen, the sound pressure level will be reestablished, and the test will commence. Alternatively, for structural panel specimens, the sound pressure level may be shaped at a level 6 dB less than the specification. The time required to shape the spectrum will be minimized to avoid inadvertent overstressing.

E. Tolerances

The test time will be within plus 10 to minus 0 percent of the time stated in the specification. The overall sound pressure level and the individual 1/3 octave band sound pressure levels will be within plus 2 to minus 2 dB of the specification. The sound pressure level tolerance applies to the frequency range of 50 through 10,000 Hz. Below this fre-

quency range, the capability of the testing facility will be the governing factor.

The test spectra shall be verified by narrowband spectral analysis using an analysis system that is independent from the analyzer/equalizer used to control the test.

SECTION V. TRANSPORTATION AND HANDLING TEST REQUIREMENTS AND PROCEDURES

Transportation and handling specifications should be used for designing and testing component shipping containers. These specifications should not influence component design, but should provide information for shipping container design to ensure that the vibration amplitudes transmitted to the component do not exceed the design amplitudes.

A. Transportation

Transportation specifications are generally presented as amplitudes in G's peak for sinusoidal sweep tests. Components should be monitored for resonances; dwell tests of 15 min each are required at each major resonance as noted during the sweep. If a component is shipped by rail, a shock test will be required to represent the train humping conditions. Any shock pulse may be used that results in a spectrum at least as severe as that specified.

Transportation tests may be eliminated if proof of adequate component protection can be provided.

B. Handling

Handling specifications are required to account for typical conditions that occur during loading or unloading operations. Tests for these conditions consist of numerous container drops from various orientations of the container.

Handling tests may be eliminated if proof of adequate component protection can be provided.

SECTION VI. ACCEPTANCE TEST REQUIREMENTS AND PROCEDURES

The requirement to do acceptance testing will be established for each program by the project manager. This document does not establish the requirement to do acceptance testing; however, it does give the acceptance test levels to be used if acceptance testing is required. If acceptance testing is required on the flight hardware, it will also be required on the qualification hardware. Acceptance test levels will be 6 dB below the qualification composite level.

Test procedures and tolerances will be the same as specified in the appropriate sections of this document.

SECTION VII. VIBRATION AND SHOCK SPECIFICATIONS

Zone 1 ET LH₂ Aft Bulkhead

Subzone 1-1 ET LH₂ Aft Bulkhead Gores (General Specifications)

Same as Subzone 1-1-A below.

Subzone 1-1-A Input to Components Mounted on the ET LH₂ Aft Bulkhead Gores. Weight of Component < 8 lbs.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.019 g²/Hz
20 - 110 Hz @ +9 dB/oct
110 - 300 Hz @ 3.12 g²/Hz
300 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.47 g²/Hz

Composite = 49.6 g_{rms}

Directions B and C

20 Hz @ 0.018 g²/Hz
20 - 130 Hz @ +6 dB/oct
130 - 340 Hz @ 0.72 g²/Hz
340 - 430 Hz @ +6 dB/oct
430 - 1000 Hz @ 1.15 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.58

Composite = 41.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.076 g²/Hz
20 - 110 Hz @ +9 dB/oct
110 - 300 Hz @ 12.50 g²/Hz
300 - 2000 Hz @ -3 dB/oct
2000 Hz @ 1.89 g²/Hz

Composite = 99.3 g_{rms}

Directions B and C

20 Hz @ 0.070 g²/Hz
20 - 130 Hz @ +6 dB/oct
130 - 340 Hz @ 2.90 g²/Hz
340 - 430 Hz @ +6 dB/oct
430 - 1000 Hz @ 4.60 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 2.30 g²/Hz

Composite = 83.0 g_{rms}

Subzone 1-1-B Input to Components Mounted on the ET LH₂ Aft Bulkhead Gores. Weight of Component ≥ 8 but < 25 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.019 \text{ g}^2/\text{Hz}$
 20 - 88 Hz @ +9 dB/oct
 88 - 300 Hz @ $1.56 \text{ g}^2/\text{Hz}$
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.24 \text{ g}^2/\text{Hz}$

Composite = $35.4 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.018 \text{ g}^2/\text{Hz}$
 20 - 92 Hz @ +6 dB/oct
 92 - 340 Hz @ $0.36 \text{ g}^2/\text{Hz}$
 340 - 430 Hz @ -3 dB/oct
 430 - 1000 Hz @ $0.58 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.29 \text{ g}^2/\text{Hz}$

Composite = $29.5 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.076 \text{ g}^2/\text{Hz}$
 20 - 88 Hz @ +9 dB/oct
 88 - 300 Hz @ $6.25 \text{ g}^2/\text{Hz}$
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.94 \text{ g}^2/\text{Hz}$

Composite = $70.9 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.070 \text{ g}^2/\text{Hz}$
 20 - 92 Hz @ +6 dB/oct
 92 - 340 Hz @ $1.45 \text{ g}^2/\text{Hz}$
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ $2.30 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $1.15 \text{ g}^2/\text{Hz}$

Composite = $59.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.25 \text{ g}^2/\text{Hz}$
 20 - 72 Hz @ +6 dB/oct
 72 - 200 Hz @ $3.10 \text{ g}^2/\text{Hz}$
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.031 \text{ g}^2/\text{Hz}$

Composite = $32.1 \text{ g}_{\text{rms}}$

Direction B and C

20 Hz @ $0.085 \text{ g}^2/\text{Hz}$
 20 - 64 Hz @ +6 dB/oct
 64 - 150 Hz @ $0.85 \text{ g}^2/\text{Hz}$
 150 - 255 Hz @ -9 dB/oct
 255 - 1000 Hz @ $0.17 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.043 \text{ g}^2/\text{Hz}$

Composite = $18.6 \text{ g}_{\text{rms}}$

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1-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 1-1-C Input to Components Mounted on the ET LH₂ Aft Bulkhead Gores. Weight of Component ≥ 25 but < 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.019 g^2 /Hz
 20 - 70 Hz @ +9 dB/oct
 70 - 300 Hz @ 0.78 g^2 /Hz
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.12 g^2 /Hz

Composite = 25.2 g_{rms}

Directions B and C

20 Hz @ 0.018 g^2 /Hz
 20 - 65 Hz @ +6 dB/oct
 65 - 340 Hz @ 0.18 g^2 /Hz
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ 0.29 g^2 /Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.14 g^2 /Hz

Composite = 20.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.076 g^2 /Hz
 20 - 70 Hz @ +9 dB/oct
 70 - 300 Hz @ 3.10 g^2 /Hz
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.47 g^2 /Hz

Composite = 50.4 g_{rms}

Directions B and C

20 Hz @ 0.070 g^2 /Hz
 20 - 65 Hz @ +6 dB/oct
 65 - 340 Hz @ 0.73 g^2 /Hz
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ 1.15 g^2 /Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.58 g^2 /Hz

Composite = 41.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.25 g^2 /Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 200 Hz @ 1.55 g^2 /Hz
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.016 g^2 /Hz

Composite = 23.2 g_{rms}

Directions B and C

20 Hz @ 0.085 g^2 /Hz
 20 - 45 Hz @ +6 dB/oct
 45 - 150 Hz @ 0.43 g^2 /Hz
 150 - 255 Hz @ -9 dB/oct
 255 - 1000 Hz @ 0.085 g^2 /Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.021 g^2 /Hz

Composite = 13.3 g_{rms}

1-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 1-1-D Input to Components Mounted on the ET LH₂ Aft Bulkhead Cores. Weight of Components ≥ 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.019 g²/Hz
 20 - 55 Hz @ +9 dB/oct
 55 - 300 Hz @ 0.39 g²/Hz
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.058 g²/Hz

Composite = 17.9 g_{rms}

Directions B and C

20 Hz @ 0.018 g²/Hz
 20 - 46 Hz @ +6 dB/oct
 46 - 340 Hz @ 0.090 g²/Hz
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ 0.14 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.072 g²/Hz

Composite = 14.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.076 g²/Hz
 20 - 55 Hz @ +9 dB/oct
 55 - 300 Hz @ 1.55 g²/Hz
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.23 g²/Hz

Composite = 35.8 g_{rms}

Directions B and C

20 Hz @ 0.070 g²/Hz
 20 - 46 Hz @ +6 dB/oct
 46 - 340 Hz @ 0.36 g²/Hz
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ 0.58 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.29 g²/Hz

Composite = 29.8 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.25 g²/Hz
 20 - 36 Hz @ +6 dB/oct
 36 - 200 Hz @ 0.78 g²/Hz
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0079 g²/Hz

Composite = 16.6 g_{rms}

Directions B and C

20 Hz @ 0.085 g²/Hz
 20 - 32 Hz @ +6 dB/oct
 32 - 150 Hz @ 0.22 g²/Hz
 150 - 255 Hz @ -9 dB/oct
 255 - 1000 Hz @ 0.043 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.011 g²/Hz

Composite = 9.6 g_{rms}

1-1-D (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

*** Design Criteria Only**

Subzone 1-2 ET LH₂ Aft Bulkhead Cap and Covers (General Specifications)

Same as Subzone 1-2-A below.

Subzone 1-2-A Input to Components Mounted on the ET LH₂ Aft Bulkhead Cap and Manhole Cover Plates. Weight of Component < 50 lbs.

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.0080 g ² /Hz	20 Hz @ 0.0072 g ² /Hz
20 - 110 Hz @ +9 dB/oct	20 - 130 Hz @ +6 dB/oct
110 - 300 Hz @ 1.30 g ² /Hz	130 - 340 Hz @ 0.30 g ² /Hz
300 - 2000 Hz @ -3 dB/oct	340 - 430 Hz @ +6 dB/oct
2000 Hz @ 0.20 g ² /Hz	430 - 1000 Hz @ 0.48 g ² /Hz
	1000 - 2000 Hz @ -3 dB/oct
	2000 Hz @ 0.24 g ² /Hz
Composite = 32.0 g _{rms}	Composite = 26.6 g _{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.032 g ² /Hz
20 - 110 Hz @ +9 dB/oct
110 - 300 Hz @ 5.20 g ² /Hz
300 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.78 g ² /Hz

Composite = 64.0 g_{rms}

Directions B and C

20 Hz @ 0.029 g ² /Hz
20 - 130 Hz @ +6 dB/oct
130 - 340 Hz @ 1.20 g ² /Hz
340 - 430 Hz @ +6 dB/oct
430 - 1000 Hz @ 1.90 g ² /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.95 g ² /Hz

Composite = 53.3 g_{rms}

1-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.11 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +6 dB/oct
100 - 200 Hz @ $2.60 \text{ g}^2/\text{Hz}$
200 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.026 \text{ g}^2/\text{Hz}$

Composite = $28.6 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.035 \text{ g}^2/\text{Hz}$
20 - 90 Hz @ +6 dB/oct
90 - 150 Hz @ $0.71 \text{ g}^2/\text{Hz}$
150 - 260 Hz @ -9 dB/oct
260 - 1000 Hz @ $0.14 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.035 \text{ g}^2/\text{Hz}$

Composite = $16.5 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 1-2-B Input to Components Mounted on the ET LH₂ Aft Bulkhead Cap and Manhole Cover Plates. Weight of Components ≥ 50 but < 150 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.0080 \text{ g}^2/\text{Hz}$
 20 - 88 Hz @ +9 dB/oct
 88 - 300 Hz @ $0.65 \text{ g}^2/\text{Hz}$
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.098 \text{ g}^2/\text{Hz}$

Composite = $22.6 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0072 \text{ g}^2/\text{Hz}$
 20 - 92 Hz @ +6 dB/oct
 92 - 340 Hz @ $0.15 \text{ g}^2/\text{Hz}$
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ $0.24 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.12 \text{ g}^2/\text{Hz}$

Composite = $18.8 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.032 \text{ g}^2/\text{Hz}$
 20 - 88 Hz @ +9 dB/oct
 88 - 300 Hz @ $2.60 \text{ g}^2/\text{Hz}$
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.39 \text{ g}^2/\text{Hz}$

Composite = $45.2 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.029 \text{ g}^2/\text{Hz}$
 20 - 92 Hz @ +6 dB/oct
 92 - 340 Hz @ $0.60 \text{ g}^2/\text{Hz}$
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ $0.95 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.48 \text{ g}^2/\text{Hz}$

Composite = $37.7 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.11 \text{ g}^2/\text{Hz}$
 20 - 70 Hz @ +6 dB/oct
 70 - 200 Hz @ $1.30 \text{ g}^2/\text{Hz}$
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.013 \text{ g}^2/\text{Hz}$

Composite = $20.8 \text{ g}_{\text{rms}}$

Direction B and C

20 Hz @ $0.035 \text{ g}^2/\text{Hz}$
 20 - 64 Hz @ +6 dB/oct
 64 - 150 Hz @ $0.36 \text{ g}^2/\text{Hz}$
 150 - 260 Hz @ -9 dB/oct
 260 - 1000 Hz @ $0.070 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.018 \text{ g}^2/\text{Hz}$

Composite = $12.0 \text{ g}_{\text{rms}}$

1-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 1-2-C Input to Components Mounted on the ET LH₂ Aft Bulkhead Cap and Manhole Cover Plates. Weight of Component ≥ 150 but < 300 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.0080 \text{ g}^2/\text{Hz}$
 20 - 70 Hz @ +9 dB/oct
 70 - 300 Hz @ $0.32 \text{ g}^2/\text{Hz}$
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.050 \text{ g}^2/\text{Hz}$

Composite = $16.3 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0072 \text{ g}^2/\text{Hz}$
 20 - 65 Hz @ +6 dB/oct
 65 - 340 Hz @ $0.075 \text{ g}^2/\text{Hz}$
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ $0.12 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.060 \text{ g}^2/\text{Hz}$

Composite = $13.5 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.032 \text{ g}^2/\text{Hz}$
 20 - 70 Hz @ +9 dB/oct
 70 - 300 Hz @ $1.30 \text{ g}^2/\text{Hz}$
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.20 \text{ g}^2/\text{Hz}$

Composite = $32.6 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.029 \text{ g}^2/\text{Hz}$
 20 - 65 Hz @ +6 dB/oct
 65 - 340 Hz @ $0.30 \text{ g}^2/\text{Hz}$
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ $0.48 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.24 \text{ g}^2/\text{Hz}$

Composite $27.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.11 \text{ g}^2/\text{Hz}$
 20 - 50 Hz @ +6 dB/oct
 50 - 200 Hz @ $0.65 \text{ g}^2/\text{Hz}$
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.0066 \text{ g}^2/\text{Hz}$

Composite = $15.0 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.035 \text{ g}^2/\text{Hz}$
 20 - 45 Hz @ +6 dB/oct
 45 - 150 Hz @ $0.18 \text{ g}^2/\text{Hz}$
 150 - 260 Hz @ -9 dB/oct
 260 - 1000 Hz @ $0.035 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.0088 \text{ g}^2/\text{Hz}$

Composite = $8.6 \text{ g}_{\text{rms}}$

1-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

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Subzone 1-2-D Input to the LH₂ Siphon on the ET LH₂ Aft Bulkhead Cap.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz 0.0080 g²/Hz
 20 - 56 Hz @ +9 dB/oct
 56 - 300 Hz @ 0.18 g²/Hz
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.027 g²/Hz

Composite = 12.0 g_{rms}

Directions B and C

20 Hz @ 0.0072 g²/Hz
 20 - 48 Hz @ +6 dB/oct
 48 - 340 Hz @ 0.040 g²/Hz
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ 0.065 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.032 g²/Hz

Composite = 10.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.032 g²/Hz
 20 - 56 Hz @ +9 dB/oct
 56 - 300 Hz @ 0.70 g²/Hz
 300 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.11 g²/Hz

Composite = 24.1 g_{rms}

Directions B and C

20 Hz @ 0.029 g²/Hz
 20 - 48 Hz @ +6 dB/oct
 48 - 340 Hz @ 0.16 g²/Hz
 340 - 430 Hz @ +6 dB/oct
 430 - 1000 Hz @ 0.26 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.13 g²/Hz

Composite 20.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.11 g²/Hz
 20 - 36 Hz @ +6 dB/oct
 36 - 200 Hz @ 0.35 g²/Hz
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0036 g²/Hz

Composite = 11.1 g_{rms}

Directions B and C

20 Hz @ 0.035 g²/Hz
 20 - 33 Hz @ +6 dB/oct
 33 - 150 Hz @ 0.096 g²/Hz
 150 - 260 Hz @ -9 dB/oct
 260 - 1000 Hz @ 0.019 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0048 g²/Hz

Composite = 6.4 g_{rms}

1-2-D (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Zone 2 ET LH₂ Cylinder

Subzone 2-1 ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Inboard Half (+Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-1-1-A below.

Subzone 2-1-1 Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Inboard Half (+Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-1-1-A below.

Subzone 2-1-1-A Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component < 15 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
20 - 75 Hz @ +6 dB/oct
75 - 150 Hz @ 0.25 g²/Hz
150 - 240 Hz @ +6 dB/oct
240 - 900 Hz @ 0.62 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.28 g²/Hz

Composite = 30.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00021 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 400 Hz @ 0.025 g²/Hz
400 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.075 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.038 g²/Hz

Composite = 9.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.074 g²/Hz
20 - 75 Hz @ +6 dB/oct
75 - 150 Hz @ 1.00 g²/Hz
150 - 240 Hz @ +6 dB/oct
240 - 900 Hz @ 2.50 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 1.13 g²/Hz

Composite = 60.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00084 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 400 Hz @ 0.10 g²/Hz
400 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.30 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.15 g²/Hz

Composite = 19.7 g_{rms}

2-1-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.016 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 1000 Hz @ 0.40 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 24.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0016 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 7.6 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-1-1-B Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Inboard Half (+Z Axis $\pm 90^\circ$).
Weight of Component ≥ 15 but < 45 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 105 Hz @ 0.12 g²/Hz
 105 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 0.32 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.14 g²/Hz

Composite = 22.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00021 g²/Hz
 20 - 78 Hz @ +9 dB/oct
 78 - 400 Hz @ 0.012 g²/Hz
 400 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.038 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.019 g²/Hz

Composite = 7.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.074 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 105 Hz @ 0.50 g²/Hz
 105 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 1.30 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.56 g²/Hz

Composite = 44.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00084 g²/Hz
 20 - 78 Hz @ +9 dB/oct
 78 - 400 Hz @ 0.050 g²/Hz
 400 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.15 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.075 g²/Hz

Composite = 14.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0081 g²/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 1000 Hz @ 0.20 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.050 g²/Hz

Composite = 17.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00080 g²/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 1000 Hz @ 0.020 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0050 g²/Hz

Composite = 5.4 g_{rms}

2-1-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 2-1-1-C Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2056 to X_t 1624), Inboard Half (+Z Axis $\pm 90^\circ$).
Weight of Component ≥ 45 lbs.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
20 - 37 Hz @ +6 dB/oct
37 - 75 Hz @ 0.062 g²/Hz
75 - 115 Hz @ +6 dB/oct
115 - 900 Hz @ 0.15 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.070 g²/Hz

Composite = 15.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00021 g²/Hz
20 - 62 Hz @ +9 dB/oct
62 - 400 Hz @ 0.0062 g²/Hz
400 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.019 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0095 g²/Hz

Composite = 4.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.074 g²/Hz
20 - 37 Hz @ +6 dB/oct
37 - 75 Hz @ 0.25 g²/Hz
75 - 115 Hz @ +6 dB/oct
115 - 900 Hz @ 0.60 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.28 g²/Hz

Composite = 30.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00084 g²/Hz
20 - 62 Hz @ +9 dB/oct
62 - 400 Hz @ 0.025 g²/Hz
400 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.075 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.038 g²/Hz

Composite = 9.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0040 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 1000 Hz @ 0.10 g²/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.025 g²/Hz

Composite = 12.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00070 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 1000 Hz @ 0.017 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0044 g²/Hz

Composite = 5.0 g_{rms}

2-1-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-1-2 Structural Ring at Station X_t 1871 in the ET LH_2 Cylinder, Inboard Half (+Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-1-2-A below.

Subzone 2-1-2-A Input to Components Mounted on the Structural Ring
At Station X_t 1871 in the ET LH_2 Cylinder, Inboard
Half (+Z Axis $\pm 90^\circ$). Weight of Component < 75 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0058 g^2/Hz
20 - 120 Hz @ +4 dB/oct
120 - 1100 Hz @ 0.062 g^2/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.019 g^2/Hz

Composite = 9.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0095 g^2/Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.14 g^2/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.058 g^2/Hz

Composite = 13.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.023 g^2/Hz
20 - 120 Hz @ +4 dB/oct
120 - 1100 Hz @ 0.25 g^2/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.076 g^2/Hz

Composite = 19.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.038 g^2/Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.55 g^2/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.23 g^2/Hz

Composite = 27.6 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0024 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 200 Hz @ 0.060 g^2/Hz
200 - 350 Hz @ -6 dB/oct
350 - 1500 Hz @ 0.020 g^2/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0085 g^2/Hz

Composite = 6.5 g_{rms}

Long. and Tang. Axes

20 - 75 Hz @ 0.0070 g^2/Hz
75 - 120 Hz @ +9 dB/oct
120 - 800 Hz @ 0.030 g^2/Hz
800 - 1000 Hz @ +6 dB/oct
1000 - 1500 Hz @ 0.050 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.028 g^2/Hz

Composite = 8.5 g_{rms}

2-1-2-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-1-2-B Input to Components Mounted on the Structural Ring
 At Station X_t 1871 in the ET LH₂ Cylinder, Inboard
 Half (+Z Axis $\pm 90^\circ$). Weight of Component ≥ 75 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0038 g²/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.032 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0098 g²/Hz

Composite = 7.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0050 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.070 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.030 g²/Hz

Composite = 9.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.015 g²/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.13 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.039 g²/Hz

Composite = 14.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.020 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.28 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.12 g²/Hz

Composite = 19.7 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0014 g²/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 200 Hz @ 0.035 g²/Hz
 200 - 350 Hz @ -6 dB/oct
 350 - 1500 Hz @ 0.012 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0049 g²/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 68 Hz @ 0.0035 g²/Hz
 68 - 110 Hz @ +9 dB/oct
 110 - 800 Hz @ 0.015 g²/Hz
 800 - 1000 Hz @ +6 dB/oct
 1000 - 1500 Hz @ 0.025 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.014 g²/Hz

Composite = 6.1 g_{rms}

2-1-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-1-3 Structural Ring at Station X_t 2058 in the ET LH_2 Cylinder, Inboard Half (+Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-1-3-A below.

Subzone 2-1-3-A Input to Components Mounted on the Structural Ring At Station X_t 2058 in the ET LH_2 Cylinder, Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component < 100 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0030 g^2/Hz
 20 - 120 Hz @ +4 dB/oct
 120 - 1100 Hz @ 0.032 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0098 g^2/Hz

Composite = 7.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0048 g^2/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.068 g^2/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.028 g^2/Hz

Composite = 9.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.012 g^2/Hz
 20 - 120 Hz @ +4 dB/oct
 120 - 1100 Hz @ 0.13 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.039 g^2/Hz

Composite = 14.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.019 g^2/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.27 g^2/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.11 g^2/Hz

Composite = 19.4 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0014 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 200 Hz @ 0.035 g^2/Hz
 200 - 350 Hz @ -6 dB/oct
 350 - 1500 Hz @ 0.012 g^2/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0049 g^2/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 75 Hz @ 0.0035 g^2/Hz
 75 - 120 Hz @ +9 dB/oct
 120 - 800 Hz @ 0.015 g^2/Hz
 800 - 1000 Hz @ +6 dB/oct
 1000 - 1500 Hz @ 0.025 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.014 g^2/Hz

Composite = 6.1 g_{rms}

2-1-3-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 2-1-3-B Input to Components Mounted on the Structural Ring
At Station X_t 2058 in the ET LH₂ Cylinder, Inboard
Half (+Z Axis $\pm 90^\circ$). Weight of Component ≥ 100 lbs.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0019 g²/Hz
20 - 100 Hz @ +4 dB/oct
100 - 1100 Hz @ 0.016 g²/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g²/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0025 g²/Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.035 g²/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.015 g²/Hz

Composite = 6.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0077 g²/Hz
20 - 100 Hz @ +4 dB/oct
100 - 1100 Hz @ 0.065 g²/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g²/Hz

Composite = 10.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0098 g²/Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.14 g²/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.059 g²/Hz

Composite = 13.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0014 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 200 Hz @ 0.035 g²/Hz
200 - 350 Hz @ -6 dB/oct
350 - 1500 Hz @ 0.012 g²/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0049 g²/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 70 Hz @ 0.0025 g²/Hz
70 - 110 Hz @ +9 dB/oct
110 - 800 Hz @ 0.010 g²/Hz
800 - 1000 Hz @ +6 dB/oct
1000 - 1500 Hz @ 0.017 g²/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0094 g²/Hz

Composite = 5.0 g_{rms}

2-1-3-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-2 ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Outboard Half (-Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-2-1-A below.

Subzone 2-2-1 Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Outboard Half (-Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-2-1-A below.

Subzone 2-2-1-A Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Outboard Half (-Z Axis $\pm 90^\circ$). Weight of Component < 15 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
 20 - 75 Hz @ +6 dB/oct
 75 - 150 Hz @ 0.25 g²/Hz
 150 - 240 Hz @ +6 dB/oct
 240 - 900 Hz @ 0.62 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.28 g²/Hz

Composite = 30.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00021 g²/Hz
 20 - 100 Hz @ +9 dB/oct
 100 - 400 Hz @ 0.025 g²/Hz
 400 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.075 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.038 g²/Hz

Composite = 9.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.074 g²/Hz
 20 - 75 Hz @ +6 dB/oct
 75 - 150 Hz @ 1.00 g²/Hz
 150 - 240 Hz @ +6 dB/oct
 240 - 900 Hz @ 2.50 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 1.13 g²/Hz

Composite = 60.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00084 g²/Hz
 20 - 100 Hz @ +9 dB/oct
 100 - 400 Hz @ 0.10 g²/Hz
 400 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.30 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.15 g²/Hz

Composite = 19.7 g_{rms}

2-2-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 70 Hz @ +6 dB/oct
70 - 1000 Hz @ 0.60 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.075 g^2/Hz

Composite = 28.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0014 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 1000 Hz @ 0.035 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 7.5 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-2-1-B Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Outboard Half (-Z Axis $\pm 90^\circ$). Weight of Component ≥ 15 but < 45 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 105 Hz @ 0.12 g²/Hz
 105 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 0.32 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.14 g²/Hz

Composite = 22.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00021 g²/Hz
 20 - 78 Hz @ +9 dB/oct
 78 - 400 Hz @ 0.012 g²/Hz
 400 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.037 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.019 g²/Hz

Composite = 7.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.074 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 105 Hz @ 0.50 g²/Hz
 105 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 1.30 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.56 g²/Hz

Composite = 44.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00084 g²/Hz
 20 - 78 Hz @ +9 dB/oct
 78 - 400 Hz @ 0.050 g²/Hz
 400 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.15 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.075 g²/Hz

Composite = 14.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.050 g²/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 1000 Hz @ 0.30 g²/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.038 g²/Hz

Composite = 20.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0014 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 1000 Hz @ 0.018 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.009 g²/Hz

Composite = 5.4 g_{rms}

2-2-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

*** Design Criteria Only**

Subzone 2-2-1-C Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 2058 to X_t 1624), Outboard Half (-Z Axis $\pm 90^\circ$).
Weight of Component ≥ 45 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
20 - 37 Hz @ +6 dB/oct
37 - 75 Hz @ 0.062 g²/Hz
75 - 115 Hz @ +6 dB/oct
115 - 900 Hz @ 0.15 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.070 g²/Hz

Composite = 15.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00021 g²/Hz
20 - 62 Hz @ +9 dB/oct
62 - 400 Hz @ 0.0062 g²/Hz
400 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.019 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0095 g²/Hz

Composite = 4.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.074 g²/Hz
20 - 37 Hz @ +6 dB/oct
37 - 75 Hz @ 0.25 g²/Hz
75 - 115 Hz @ +6 dB/oct
115 - 900 Hz @ 0.60 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.28 g²/Hz

Composite = 30.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00084 g²/Hz
20 - 62 Hz @ +9 dB/oct
62 - 400 Hz @ 0.025 g²/Hz
400 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.075 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.038 g²/Hz

Composite = 9.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.024 g²/Hz
20 - 50 Hz @ +6 dB/oct
50 - 1000 Hz @ 0.15 g²/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.019 g²/Hz

Composite = 14.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0014 g²/Hz
20 - 72 Hz @ +6 dB/oct
72 - 1000 Hz @ 0.015 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0076 g²/Hz

Composite = 5.0 g_{rms}

2-2-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-2-2 Structural Ring at Station X_t 1871 in the ET LH₂ Cylinder, Outboard Half (-Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-2-2-A below.

**Subzone 2-2-2-A Input to Components Mounted on the Structural Ring
At Station X_t 1871 in the ET LH₂ Cylinder, Outboard Half (-Z Axis $\pm 90^\circ$). Weight of Component < 60 lbs.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0075 g²/Hz
20 - 120 Hz @ +4 dB/oct
120 - 1100 Hz @ 0.080 g²/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.024 g²/Hz

Composite = 11.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g²/Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.17 g²/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.075 g²/Hz

Composite = 15.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.030 g²/Hz
20 - 120 Hz @ +4 dB/oct
120 - 1100 Hz @ 0.32 g²/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.097 g²/Hz

Composite = 22.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.049 g²/Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.70 g²/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.30 g²/Hz

Composite = 31.2 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.017 g²/Hz
20 - 80 Hz @ +4 dB/oct
80 - 200 Hz @ 0.11 g²/Hz
200 - 300 Hz @ -10 dB/oct
300 - 1500 Hz @ 0.030 g²/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.017 g²/Hz

Composite = 8.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.023 g²/Hz
20 - 40 Hz @ +3 dB/oct
40 - 600 Hz @ 0.045 g²/Hz
600 - 1000 Hz @ +3 dB/oct
1000 - 1500 Hz @ 0.075 g²/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.042 g²/Hz

Composite = 10.7 g_{rms}

2-2-2-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-2-2-B Input to Components Mounted on the Structural Ring
 At Station X_t 1871 in the ET LH₂ Cylinder, Outboard
 Half (-Z Axis $\pm 90^\circ$). Weight of Component ≥ 60 lbs.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0047 g²/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.040 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.012 g²/Hz

Composite = 7.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0060 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.087 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.037 g²/Hz

Composite = 11.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.019 g²/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.16 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.049 g²/Hz

Composite = 15.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.024 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.35 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g²/Hz

Composite = 22.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0087 g²/Hz
 20 - 80 Hz @ +4 dB/oct
 80 - 200 Hz @ 0.055 g²/Hz
 200 - 300 Hz @ -10 dB/oct
 300 - 1500 Hz @ 0.015 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0085 g²/Hz

Composite = 5.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.011 g²/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 600 Hz @ 0.022 g²/Hz
 600 - 1000 Hz @ +3 dB/oct
 1000 - 1500 Hz @ 0.037 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.021 g²/Hz

Composite = 7.5 g_{rms}

2-2-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-2-3 Structural Ring at Station X_t 2058 in the ET LH₂ Cylinder, Outboard Half (-Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-2-3-A below.

Subzone 2-2-3-A Input to Components Mounted on the Structural Ring At Station X_t 2058 in the ET LH₂ Cylinder, Outboard Half (-Z Axis $\pm 90^\circ$). Weight of Component < 100 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0030 g²/Hz
 20 - 120 Hz @ +4 dB/oct
 120 - 1100 Hz @ 0.032 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.098 g²/Hz

Composite = 7.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0048 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.068 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.038 g²/Hz

Composite = 9.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.012 g²/Hz
 20 - 120 Hz @ +4 dB/oct
 120 - 1100 Hz @ 0.13 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.039 g²/Hz

Composite = 14.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.019 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.27 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.11 g²/Hz

Composite = 19.4 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0073 g²/Hz
 20 - 80 Hz @ +4 dB/oct
 80 - 200 Hz @ 0.046 g²/Hz
 200 - 300 Hz @ -10 dB/oct
 300 - 1500 Hz @ 0.012 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0068 g²/Hz

Composite = 5.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0093 g²/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 600 Hz @ 0.018 g²/Hz
 600 - 1000 Hz @ +3 dB/oct
 1000 - 1500 Hz @ 0.030 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.017 g²/Hz

Composite = 6.8 g_{rms}

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2-2-3-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 2-2-3-B Input to Components Mounted on the Structural Ring
 At Station X_t 2058 in the ET LH₂ Cylinder, Outboard
 Half (-Z Axis $\pm 90^\circ$). Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0019 g²/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.016 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0050 g²/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0025 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.035 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.015 g²/Hz

Composite = 6.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0077 g²/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.065 g²/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g²/Hz

Composite = 10.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0098 g²/Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.14 g²/Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.059 g²/Hz

Composite = 13.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0066 g²/Hz
 20 - 80 Hz @ +4 dB/oct
 80 - 200 Hz @ 0.041 g²/Hz
 200 - 300 Hz @ -10 dB/oct
 300 - 1500 Hz @ 0.011 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0061 g²/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0049 g²/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 600 Hz @ 0.0098 g²/Hz
 600 - 1000 Hz @ +3 dB/oct
 1000 - 1500 Hz @ 0.016 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0092 g²/Hz

Composite = 5.0 g_{rms}

2-2-3-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 2-3 ET LH₂ Cylinder, Forward Section (Stations X_t 1624 to X_t 1123), Inboard Half (+Z Axis $\pm 90^\circ$), (General Specifications)

Same as Subzone 2-3-1-A below.

Subzone 2-3-1 Baffles and Stiffened Skin on the ET LH₂ Cylinder, Forward Section (Stations X_t 1624 to X_t 1123), Inboard Half (+Z Axis $\pm 90^\circ$), (General Specifications)

Same as Subzone 2-3-1-A below.

Subzone 2-3-1-A Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Forward Section (Stations X_t 1624 to X_t 1123), Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component < 15 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.011 g²/Hz
 20 - 130 Hz @ +9 dB/oct
 130 - 270 Hz @ 3.00 g²/Hz
 270 - 325 Hz @ -6 dB/oct
 325 - 900 Hz @ 2.02 g²/Hz
 900 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.41 g²/Hz

Composite = 53.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00037 g²/Hz
 20 - 95 Hz @ +9 dB/oct
 95 - 180 Hz @ 0.040 g²/Hz
 180 - 260 Hz @ +10 dB/oct
 260 - 600 Hz @ 0.14 g²/Hz
 600 - 670 Hz @ +10 dB/oct
 670 - 1000 Hz @ 0.20 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.10 g²/Hz

Composite = 16.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.042 g²/Hz
 20 - 75 Hz @ +6 dB/oct
 75 - 170 Hz @ 0.56 g²/Hz
 170 - 240 Hz @ +6 dB/oct
 240 - 900 Hz @ 1.13 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.51 g²/Hz

Composite = 41.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00039 g²/Hz
 20 - 100 Hz @ +9 dB/oct
 100 - 440 Hz @ 0.048 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.12 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.061 g²/Hz

Composite = 12.6 g_{rms}

2-3-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.044 g^2 /Hz
20 - 130 Hz @ +9 dB/oct
130 - 270 Hz @ 12.0 g^2 /Hz
270 - 325 Hz @ -6 dB/oct
325 - 900 Hz @ 8.1 g^2 /Hz
900 - 2000 Hz @ -6 dB/oct
2000 Hz @ 1.65 g^2 /Hz

Composite = 106.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0015 g^2 /Hz
20 - 95 Hz @ +9 dB/oct
95 - 180 Hz @ 0.16 g^2 /Hz
180 - 260 Hz @ +10 dB/oct
260 - 600 Hz @ 0.56 g^2 /Hz
600 - 670 Hz @ +10 dB/oct
670 - 1000 Hz @ 0.81 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.41 g^2 /Hz

Composite = 33.3 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-3-1-B Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Forward Section
(Stations X_t 1624 to X_t 1123), Inboard Half (+Z Axis ±90°). Weight of Component ≥ 15 but < 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.011 g²/Hz
 20 - 120 Hz @ +9 dB/oct
 120 - 250 Hz @ 1.50 g²/Hz
 250 - 325 Hz @ -6 dB/oct
 325 - 1000 Hz @ 1.01 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.40 g²/Hz

Composite = 37.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00037 g²/Hz
 20 - 75 Hz @ +9 dB/oct
 75 - 142 Hz @ 0.020 g²/Hz
 142 - 210 Hz @ +10 dB/oct
 210 - 600 Hz @ 0.070 g²/Hz
 600 - 670 Hz @ +10 dB/oct
 670 - 1000 Hz @ 0.10 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.050 g²/Hz

Composite = 11.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.042 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 120 Hz @ 0.28 g²/Hz
 120 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 0.56 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.26 g²/Hz

Composite = 29.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00039 g²/Hz
 20 - 80 Hz @ +9 dB/oct
 80 - 440 Hz @ 0.024 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.060 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.030 g²/Hz

Composite = 8.9 g_{rms}

2-3-1-B (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.044 g^2 /Hz
20 - 104 Hz @ +9 dB/oct
104 - 270 Hz @ 6.00 g^2 /Hz
270 - 325 Hz @ -6 dB/oct
325 - 900 Hz @ 4.05 g^2 /Hz
900 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.82 g^2 /Hz

Composite = 75.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0015 g^2 /Hz
20 - 75 Hz @ +9 dB/oct
75 - 142 Hz @ 0.080 g^2 /Hz
142 - 210 Hz @ +10 dB/oct
210 - 600 Hz @ 0.28 g^2 /Hz
600 - 670 Hz @ +10 dB/oct
670 - 1000 Hz @ 0.40 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.20 g^2 /Hz

Composite = 23.7 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-3-1-C Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Forward Section (Stations X_t 1624 to X_t 1123), Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component ≥ 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.011 g²/Hz
 20 - 82 Hz @ +9 dB/oct
 82 - 270 Hz @ 0.75 g²/Hz
 270 - 325 Hz @ -6 dB/oct
 325 - 900 Hz @ 0.50 g²/Hz
 900 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.20 g²/Hz

Composite = 27.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00037 g²/Hz
 20 - 60 Hz @ +9 dB/oct
 60 - 113 Hz @ 0.010 g²/Hz
 113 - 165 Hz @ +10 dB/oct
 165 - 600 Hz @ 0.035 g²/Hz
 600 - 670 Hz @ +10 dB/oct
 670 - 1000 Hz @ 0.050 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.025 g²/Hz

Composite = 8.4 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.042 g²/Hz
 20 - 37 Hz @ +6 dB/oct
 37 - 85 Hz @ 0.14 g²/Hz
 85 - 120 Hz @ +6 dB/oct
 120 - 900 Hz @ 0.28 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.13 g²/Hz

Composite = 20.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00039 g²/Hz
 20 - 63 Hz @ +9 dB/oct
 63 - 440 Hz @ 0.012 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.030 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.015 g²/Hz

Composite = 6.4 g_{rms}

2-3-1-C (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.044 g^2 /Hz
20 - 82 Hz @ +9 dB/oct
82 - 270 Hz @ 3.00 g^2 /Hz
270 - 325 Hz @ -6 dB/oct
325 - 900 Hz @ 2.02 g^2 /Hz
900 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.41 g^2 /Hz

Composite = 54.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0015 g^2 /Hz
20 - 60 Hz @ +9 dB/oct
60 - 113 Hz @ 0.040 g^2 /Hz
113 - 165 Hz @ +10 dB/oct
165 - 600 Hz @ 0.14 g^2 /Hz
600 - 670 Hz @ +10 dB/oct
670 - 1000 Hz @ 0.20 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.10 g^2 /Hz

Composite = 16.9 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

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Subzone 2-3-2 Structural Rings at Stations X_t 1624 and X_t 1377 in the ET LH₂ Cylinder, Inboard Half (+Z Axis $\pm 90^\circ$).
(General Specifications)

Same as Subzone 2-3-2-A below.

Subzone 2-3-2-A Input to Components Mounted on the Structural Rings
At Stations X_t 1624 and X_t 1377 in the ET LH₂ Cylinder,
Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component
< 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0080 g²/Hz
20 - 60 Hz @ +9 dB/oct
60 - 200 Hz @ 0.20 g²/Hz
200 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 4.00 g²/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.19 g²/Hz

Composite = 54.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g²/Hz
20 - 60 Hz @ +9 dB/oct
60 - 125 Hz @ 0.032 g²/Hz
125 - 440 Hz @ +10 dB/oct
440 - 800 Hz @ 2.12 g²/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.10 g²/Hz

Composite = 40.3 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0061 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 290 Hz @ 0.15 g²/Hz
290 - 500 Hz @ +9 dB/oct
500 - 850 Hz @ 0.80 g²/Hz
850 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.15 g²/Hz

Composite = 28.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0065 g²/Hz
20 - 60 Hz @ +6 dB/oct
60 - 190 Hz @ 0.060 g²/Hz
190 - 340 Hz @ +9 dB/oct
340 - 2000 Hz @ 0.34 g²/Hz

Composite = 24.2 g_{rms}

2-3-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.032 \text{ g}^2/\text{Hz}$
20 - 60 Hz @ +9 dB/oct
60 - 200 Hz @ $0.80 \text{ g}^2/\text{Hz}$
200 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ $16.0 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.76 \text{ g}^2/\text{Hz}$

Composite = $108.1 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.048 \text{ g}^2/\text{Hz}$
20 - 60 Hz @ +9 dB/oct
60 - 125 Hz @ $0.13 \text{ g}^2/\text{Hz}$
125 - 440 Hz @ +10 dB/oct
440 - 800 Hz @ $8.50 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.40 \text{ g}^2/\text{Hz}$

Composite = $80.7 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 2-3-2-B Input to Components Mounted on the Structural Rings
At Stations X_t 1624 and X_t 1377 in the ET LH_2 Cylinder,
Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component
 ≥ 30 but < 90 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0065 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 200 Hz @ 0.10 g^2/Hz
200 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 2.00 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.095 g^2/Hz

Composite = 38.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00077 g^2/Hz
20 - 55 Hz @ +9 dB/oct
55 - 125 Hz @ 0.016 g^2/Hz
125 - 440 Hz @ +10 dB/oct
440 - 800 Hz @ 1.06 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.050 g^2/Hz

Composite = 28.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0061 g^2/Hz
20 - 72 Hz @ +6 dB/oct
72 - 290 Hz @ 0.075 g^2/Hz
290 - 500 Hz @ +9 dB/oct
500 - 850 Hz @ 0.40 g^2/Hz
850 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.072 g^2/Hz

Composite = 19.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0065 g^2/Hz
20 - 42 Hz @ +6 dB/oct
42 - 190 Hz @ 0.030 g^2/Hz
190 - 340 Hz @ +9 dB/oct
340 - 2000 Hz @ 0.17 g^2/Hz

Composite = 17.4 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.026 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 200 Hz @ 0.40 g^2/Hz
200 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 8.00 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.38 g^2/Hz

Composite = 76.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0031 g^2/Hz
20 - 55 Hz @ +9 dB/oct
55 - 125 Hz @ 0.065 g^2/Hz
125 - 440 Hz @ +10 dB/oct
440 - 800 Hz @ 4.25 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.20 g^2/Hz

Composite = 57.1 g_{rms}

2-3-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

*** Design Criteria Only**

Subzone 2-3-2-C Input to Components Mounted on the Structural Ring
At Stations X_t 1624 and X_t 1377 in the ET LH₂ Cylinder,
Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component
 ≥ 90 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0065 g²/Hz
 20 - 40 Hz @ +9 dB/oct
 40 - 200 Hz @ 0.050 g²/Hz
 200 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 1.00 g²/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.042 g²/Hz

Composite = 27.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00075 g²/Hz
 20 - 44 Hz @ +9 dB/oct
 44 - 125 Hz @ 0.0080 g²/Hz
 125 - 440 Hz @ +10 dB/oct
 440 - 800 Hz @ 0.53 g²/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.025 g²/Hz

Composite = 20.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0061 g²/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 290 Hz @ 0.038 g²/Hz
 290 - 500 Hz @ +9 dB/oct
 500 - 850 Hz @ 0.20 g²/Hz
 850 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.036 g²/Hz

Composite = 14.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0065 g²/Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 190 Hz @ 0.015 g²/Hz
 190 - 340 Hz @ +9 dB/oct
 340 - 2000 Hz @ 0.085 g²/Hz

Composite = 12.1 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.026 g²/Hz
 20 - 40 Hz @ +9 dB/oct
 40 - 200 Hz @ 0.20 g²/Hz
 200 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 4.00 g²/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.12 g²/Hz

Composite = 54.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0030 g²/Hz
 20 - 44 Hz @ +9 dB/oct
 44 - 125 Hz @ 0.032 g²/Hz
 125 - 440 Hz @ +10 dB/oct
 440 - 800 Hz @ 2.12 g²/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.10 g²/Hz

Composite = 40.3 g_{rms}

2-3-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

*** Design Criteria Only**

Subzone 2-3-3 Structural Ring At Station X_t 1130 in the ET LH₂ Cylinder, Inboard Half (+Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-3-3-A below.

Subzone 2-3-3-A Input to Components Mounted on the Structural Ring At Station X_t 1130 in the ET LH₂ Cylinder, Inboard Half (+Z Axis $\pm 90^\circ$). Weight of Component < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2 /Hz
20 - 130 Hz @ +4 dB/oct
130 - 1500 Hz @ 0.17 g^2 /Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.097 g^2 /Hz

Composite = 17.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2 /Hz
20 - 700 Hz @ +3 dB/oct
700 - 1500 Hz @ 0.40 g^2 /Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.24 g^2 /Hz

Composite = 23.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.016 g^2 /Hz
20 - 120 Hz @ +4 dB/oct
120 - 200 Hz @ 0.18 g^2 /Hz
200 - 250 Hz @ -9 dB/oct
250 - 1400 Hz @ 0.090 g^2 /Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.031 g^2 /Hz

Composite = 12.8 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.032 g^2 /Hz
50 - 1000 Hz @ +2 dB/oct
1000 - 1400 Hz @ 0.26 g^2 /Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.13 g^2 /Hz

Composite = 19.1 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.058 g^2 /Hz
20 - 130 Hz @ +4 dB/oct
130 - 1500 Hz @ 0.70 g^2 /Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.39 g^2 /Hz

Composite = 35.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.048 g^2 /Hz
20 - 700 Hz @ +3 dB/oct
700 - 1500 Hz @ 1.60 g^2 /Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.99 g^2 /Hz

Composite = 47.5 g_{rms}

2-3-3-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-3-3-B Input to Components Mounted on the Structural Ring
At Station X_t 1130 in the ET LH₂ Cylinder, Inboard
Half (+Z Axis $\pm 90^\circ$). Weight of Component ≥ 100 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0072 g^2 /Hz
 20 - 130 Hz @ +4 dB/oct
 130 - 1500 Hz @ 0.087 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.047 g^2 /Hz

Composite = 12.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0060 g^2 /Hz
 20 - 700 Hz @ +3 dB/oct
 700 - 1500 Hz @ 0.20 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.12 g^2 /Hz

Composite = 16.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.11 g^2 /Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 200 Hz @ 0.090 g^2 /Hz
 200 - 250 Hz @ -9 dB/oct
 250 - 1400 Hz @ 0.045 g^2 /Hz
 1400 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.015 g^2 /Hz

Composite = 9.1 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.016 g^2 /Hz
 50 - 1000 Hz @ +2 dB/oct
 1000 - 1400 Hz @ 0.13 g^2 /Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.065 g^2 /Hz

Composite = 13.5 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.029 g^2 /Hz
 20 - 130 Hz @ +4 dB/oct
 130 - 1500 Hz @ 0.35 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.19 g^2 /Hz

Composite = 25.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.024 g^2 /Hz
 20 - 700 Hz @ +3 dB/oct
 700 - 1500 Hz @ 0.80 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.50 g^2 /Hz

Composite = 33.6 g_{rms}

2-3-3-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-4 ET LH₂ Cylinder, Forward Section (Stations X_t 1624 to X_t 1130), Outboard Half (-Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-4-1-A below.

Subzone 2-4-1 Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 1624 to X_t 1130), Outboard Half (-Z Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-4-1-A below.

Subzone 2-4-1-A Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 1624 to X_t 1130), Outboard Half (-Z Axis $\pm 90^\circ$).
Weight of Component < 15 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g²/Hz
20 - 75 Hz @ +6 dB/oct
75 - 170 Hz @ 0.18 g²/Hz
170 - 240 Hz @ +6 dB/oct
240 - 900 Hz @ 0.35 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.16 g²/Hz

Composite = 22.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00012 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 440 Hz @ 0.015 g²/Hz
440 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.038 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.019 g²/Hz

Composite = 7.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.052 g²/Hz
20 - 75 Hz @ +6 dB/oct
75 - 170 Hz @ 0.70 g²/Hz
170 - 240 Hz @ +6 dB/oct
240 - 900 Hz @ 1.40 g²/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.63 g²/Hz

Composite = 45.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00048 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 440 Hz @ 0.060 g²/Hz
440 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.15 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.075 g²/Hz

Composite = 14.0 g_{rms}

2-4-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 125 Hz @ +6 dB/oct
125 - 200 Hz @ 2.00 g^2/Hz
200 - 340 Hz @ -9 dB/oct
340 - 1000 Hz @ 0.40 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 28.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0014 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 1000 Hz @ 0.035 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 7.5 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

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Subzone 2-4-1-B Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 1624 to X_t 1130), Outboard Half (-Z Axis $\pm 90^\circ$).
Weight of Component ≥ 15 but < 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 120 Hz @ 0.088 g²/Hz
 120 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 0.18 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.080 g²/Hz

Composite = 16.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00012 g²/Hz
 20 - 80 Hz @ +9 dB/oct
 80 - 440 Hz @ 0.0075 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.019 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0095 g²/Hz

Composite = 4.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.052 g²/Hz
 20 - 52 Hz @ +6 dB/oct
 52 - 120 Hz @ 0.35 g²/Hz
 120 - 170 Hz @ +6 dB/oct
 170 - 900 Hz @ 0.70 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.32 g²/Hz

Composite = 32.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00048 g²/Hz
 20 - 80 Hz @ +9 dB/oct
 80 - 440 Hz @ 0.030 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.075 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.038 g²/Hz

Composite = 9.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.052 g²/Hz
 20 - 87 Hz @ +6 dB/oct
 87 - 200 Hz @ 1.00 g²/Hz
 200 - 340 Hz @ -9 dB/oct
 340 - 1000 Hz @ 0.20 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.050 g²/Hz

Composite = 20.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0014 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 1000 Hz @ 0.018 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0090 g²/Hz

Composite = 5.4 g_{rms}

2-4-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

*** Design Criteria Only**

Subzone 2-4-1-C Input to Components Mounted on Baffles and Stiffened Skin on the ET LH₂ Cylinder, Aft Section (Stations X_t 1624 to X_t 1130). Outboard Half (-Z Axis $\pm 90^\circ$). Weight of Component ≥ 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g²/Hz
 20 - 37 Hz @ +6 dB/oct
 37 - 85 Hz @ 0.045 g²/Hz
 85 - 120 Hz @ +6 dB/oct
 120 - 900 Hz @ 0.088 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.040 g²/Hz

Composite = 11.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00012 g²/Hz
 20 - 63 Hz @ +9 dB/oct
 63 - 440 Hz @ 0.0038 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.0095 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0048 g²/Hz

Composite = 3.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.052 g²/Hz
 20 - 37 Hz @ +6 dB/oct
 37 - 85 Hz @ 0.18 g²/Hz
 85 - 120 Hz @ +6 dB/oct
 120 - 900 Hz @ 0.35 g²/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.16 g²/Hz

Composite = 23.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00048 g²/Hz
 20 - 63 Hz @ +9 dB/oct
 63 - 440 Hz @ 0.015 g²/Hz
 440 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ 0.038 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.019 g²/Hz

Composite = 7.1 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.052 g²/Hz
 20 - 62 Hz @ +6 dB/oct
 62 - 200 Hz @ 0.50 g²/Hz
 200 - 340 Hz @ -9 dB/oct
 340 - 1000 Hz @ 0.10 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.025 g²/Hz

Composite = 15.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0014 g²/Hz
 20 - 67 Hz @ +6 dB/oct
 67 - 1000 Hz @ 0.015 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0076 g²/Hz

Composite = 5.4 g_{rms}

2-4-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-4-2 Structural Rings at Stations X_t 1624 and X_t 1377 in the
ET LH_2 Cylinder, Outboard Half ($-Z$ Axis $\pm 90^\circ$).
(General Specifications)

Same as Subzone 2-4-2-A below.

Subzone 2-4-2-A Input to Components Mounted on the Structural Rings
At Stations X_t 1624 and X_t 1377 in the ET LH_2 Cylinder,
Outboard Half ($-Z$ Axis $\pm 90^\circ$). Weight of Component
< 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0021 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 280 Hz @ 0.052 g^2/Hz
280 - 490 Hz @ +9 dB/oct
490 - 800 Hz @ 0.28 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.045 g^2/Hz

Composite = 16.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0024 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 190 Hz @ 0.022 g^2/Hz
190 - 340 Hz @ +9 dB/oct
340 - 2000 Hz @ 0.12 g^2/Hz

Composite = 14.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0085 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 280 Hz @ 0.21 g^2/Hz
280 - 490 Hz @ +9 dB/oct
490 - 800 Hz @ 1.10 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.18 g^2/Hz

Composite = 32.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0096 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 190 Hz @ 0.088 g^2/Hz
190 - 340 Hz @ +9 dB/oct
340 - 2000 Hz @ 0.50 g^2/Hz

Composite = 20.3 g_{rms}

2-4-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.034 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 280 Hz @ 0.30 g^2/Hz
280 - 500 Hz @ +6 dB/oct
500 - 700 Hz @ 1.00 g^2/Hz
700 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.031 g^2/Hz

Composite = 26.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0067 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 270 Hz @ 0.060 g^2/Hz
270 - 460 Hz @ +10 dB/oct
460 - 800 Hz @ 0.36 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.017 g^2/Hz

Composite = 16.7 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-4-2-B Input to Components Mounted on the Structural Rings
At Stations X_t 1624 and X_t 1377 in the ET LH₂ Cylinder,
Outboard Half ($-Z$ Axis $\pm 90^\circ$). Weight of Component
 ≥ 30 but < 90 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0021 g^2/Hz
 20 - 71 Hz @ +6 dB/oct
 71 - 280 Hz @ 0.028 g^2/Hz
 280 - 490 Hz @ +9 dB/oct
 490 - 800 Hz @ 0.14 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 1.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0024 g^2/Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 190 Hz @ 0.011 g^2/Hz
 190 - 340 Hz @ +9 dB/oct
 340 - 2000 Hz @ 0.062 g^2/Hz

Composite = 10.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0085 g^2/Hz
 20 - 71 Hz @ +6 dB/oct
 71 - 280 Hz @ 0.11 g^2/Hz
 280 - 490 Hz @ +9 dB/oct
 490 - 800 Hz @ 0.55 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.089 g^2/Hz

Composite = 22.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0096 g^2/Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 190 Hz @ 0.044 g^2/Hz
 190 - 340 Hz @ +9 dB/oct
 340 - 2000 Hz @ 0.25 g^2/Hz

Composite = 21.2 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.024 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 280 Hz @ 0.15 g^2/Hz
 280 - 500 Hz @ +6 dB/oct
 500 - 700 Hz @ 0.50 g^2/Hz
 700 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.015 g^2/Hz

Composite = 18.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0048 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 270 Hz @ 0.030 g^2/Hz
 270 - 460 Hz @ +10 dB/oct
 460 - 800 Hz @ 0.18 g^2/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0086 g^2/Hz

Composite = 11.8 g_{rms}

2-4-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*

5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*

5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 2-4-2-C Input to Components Mounted on the Structural Rings
At Stations X_t 1624 and X_t 1377 in the ET LH₂ Cylinder,
Outboard Half (-Z Axis $\pm 90^\circ$). Weight of Component
 ≥ 90 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0021 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 280 Hz @ 0.014 g^2/Hz
280 - 490 Hz @ +9 dB/oct
490 - 800 Hz @ 0.070 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.011 g^2/Hz

Composite = 8.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0024 g^2/Hz
20 - 30 Hz @ +6 dB/oct
30 - 190 Hz @ 0.0055 g^2/Hz
190 - 340 Hz @ +9 dB/oct
340 - 2000 Hz @ 0.030 g^2/Hz

Composite = 7.3 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0085 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 280 Hz @ 0.055 g^2/Hz
280 - 490 Hz @ +9 dB/oct
490 - 800 Hz @ 0.28 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.045 g^2/Hz

Composite = 16.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0096 g^2/Hz
20 - 30 Hz @ +6 dB/oct
30 - 190 Hz @ 0.022 g^2/Hz
190 - 340 Hz @ +9 dB/oct
340 - 2000 Hz @ 0.12 g^2/Hz

Composite = 14.7 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.15 g^2/Hz
20 - 45 Hz @ +6 dB/oct
45 - 280 Hz @ 0.075 g^2/Hz
280 - 500 Hz @ +6 dB/oct
500 - 700 Hz @ 0.25 g^2/Hz
700 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0075 g^2/Hz

Composite = 13.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0030 g^2/Hz
20 - 45 Hz @ +6 dB/oct
45 - 270 Hz @ 0.015 g^2/Hz
270 - 460 Hz @ +10 dB/oct
460 - 800 Hz @ 0.000 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 8.4 g_{rms}

2-4-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

*** Design Criteria Only**

Subzone 2-4-3 Structural Ring at Station X_t 1130 in the ET LH_2 Cylinder, Outboard Half ($-Z$ Axis $\pm 90^\circ$). (General Specifications)

Same as Subzone 2-4-3-A below.

Subzone 2-4-3-A Input to Components Mounted on the Structural Ring
At Station X_t 1130 in the ET LH_2 Cylinder, Outboard Half ($-Z$ Axis $\pm 90^\circ$). Weight of Component < 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0070 g^2/Hz
20 - 120 Hz @ +4 dB/oct
120 - 200 Hz @ 0.075 g^2/Hz
200 - 250 Hz @ -9 dB/oct
250 - 1400 Hz @ 0.038 g^2/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.013 g^2/Hz

Composite = 8.3 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.014 g^2/Hz
50 - 1000 Hz @ +2 dB/oct
1000 - 1400 Hz @ 0.11 g^2/Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.055 g^2/Hz

Composite = 12.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.028 g^2/Hz
20 - 120 Hz @ +4 dB/oct
120 - 200 Hz @ 0.30 g^2/Hz
200 - 250 Hz @ -9 dB/oct
250 - 1400 Hz @ 0.15 g^2/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.052 g^2/Hz

Composite = 16.6 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.056 g^2/Hz
50 - 1000 Hz @ +2 dB/oct
1000 - 1400 Hz @ 0.45 g^2/Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.22 g^2/Hz

Composite = 25.2 g_{rms}

2-4-3-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.024 g^2/Hz
20 - 80 Hz @ +4 dB/oct
80 - 200 Hz @ 0.15 g^2/Hz
200 - 300 Hz @ -10 dB/oct
300 - 1500 Hz @ 0.040 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.023 g^2/Hz

Composite = 10.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.030 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 600 Hz @ 0.060 g^2/Hz
600 - 1000 Hz @ +3 dB/oct
1000 - 1500 Hz @ 0.10 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.056 g^2/Hz

Composite = 12.4 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-4-3-B Input to Components Mounted on the Structural Ring
At Station X_t 1130 in the ET LH₂ Cylinder, Outboard
Half (-Z Axis $\pm 90^\circ$). Weight of Component ≥ 45 but
< 135 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0045 g²/Hz
20 - 100 Hz @ +4 dB/oct
100 - 200 Hz @ 0.038 g²/Hz
200 - 250 Hz @ -9 dB/oct
250 - 1400 Hz @ 0.019 g²/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0062 g²/Hz

Composite = 5.9 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.0070 g²/Hz
50 - 1000 Hz @ +2 dB/oct
1000 - 1400 Hz @ 0.058 g²/Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.028 g²/Hz

Composite = 9.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g²/Hz
20 - 100 Hz @ +4 dB/oct
100 - 200 Hz @ 0.15 g²/Hz
200 - 250 Hz @ -9 dB/oct
250 - 1400 Hz @ 0.075 g²/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.025 g²/Hz

Composite = 11.8 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.028 g²/Hz
50 - 1000 Hz @ +2 dB/oct
1000 - 1400 Hz @ 0.23 g²/Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.11 g²/Hz

Composite = 18.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.014 g²/Hz
20 - 80 Hz @ +4 dB/oct
80 - 190 Hz @ 0.090 g²/Hz
190 - 300 Hz @ -10 dB/oct
300 - 1500 Hz @ 0.020 g²/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.011 g²/Hz

Composite = 7.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.015 g²/Hz
20 - 40 Hz @ +3 dB/oct
40 - 600 Hz @ 0.030 g²/Hz
600 - 1000 Hz @ +3 dB/oct
1000 - 1500 Hz @ 0.050 g²/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.028 g²/Hz

Composite = 8.8 g_{rms}

2-4-3-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 2-4-3-C Input to Components Mounted on the Structural Ring
 At Station X_t 1130 in the ET LH₂ Cylinder, Outboard
 Half (-Z Axis $\pm 90^\circ$). Weight of Component ≥ 135 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0030 g²/Hz
 20 - 80 Hz @ +4 dB/oct
 80 - 200 Hz @ 0.019 g²/Hz
 200 - 250 Hz @ -9 dB/oct
 250 - 1400 Hz @ 0.095 g²/Hz
 1400 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0032 g²/Hz

Composite = 4.2 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.035 g²/Hz
 50 - 1000 Hz @ +2 dB/oct
 1000 - 1400 Hz @ 0.030 g²/Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.017 g²/Hz

Composite = 6.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.012 g²/Hz
 20 - 80 Hz @ +4 dB/oct
 80 - 200 Hz @ 0.075 g²/Hz
 200 - 250 Hz @ -9 dB/oct
 250 - 1400 Hz @ 0.038 g²/Hz
 1400 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.013 g²/Hz

Composite = 8.5 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.011 g²/Hz
 50 - 1000 Hz @ +2 dB/oct
 1000 - 1400 Hz @ 0.12 g²/Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.059 g²/Hz

Composite = 13.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.011 g²/Hz
 20 - 70 Hz @ +4 dB/oct
 70 - 175 Hz @ 0.060 g²/Hz
 175 - 300 Hz @ -10 dB/oct
 300 - 1500 Hz @ 0.010 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0056 g²/Hz

Composite = 5.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0075 g²/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 600 Hz @ 0.015 g²/Hz
 600 - 1000 Hz @ +3 dB/oct
 1000 - 1500 Hz @ 0.025 g²/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.014 g²/Hz

Composite = 6.2 g_{rms}

2-4-3-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Zone 3**ET Intertank****Subzone 3-1**

ET Intertank (Stations X_t 1130 to X_t 852), Panels 1, 2, and 3 (General Specifications)

Same as Subzone 3-1-1-A below.

Subzone 3-1-1

Structural Rings at Stations X_t 1082, X_t 1034, X_t 941, and X_t 897 in Panels 1, 2, and 3 of the ET Intertank (General Specifications)

Same as Subzone 3-1-1-A below.

Subzone 3-1-1-A

Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034, X_t 941, and X_t 807 in Panels 1, 2, and 3 of the ET Intertank. Weight of Component < 25 lb.

1. Acceptance Test Criteria (1 min/axis)**Radial Axis**

20 Hz @ 0.16 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 1.00 g^2 /Hz
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ 0.25 g^2 /Hz
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 1.00 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.047 g^2 /Hz

Composite = 29.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.045 g^2 /Hz
20 - 40 Hz @ +6 dB/oct
40 - 320 Hz @ 0.17 g^2 /Hz
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.032 g^2 /Hz

Composite = 20.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)**Radial Axis**

20 Hz @ 0.010 g^2 /Hz
20 - 110 Hz @ +6 dB/oct
110 - 350 Hz @ 0.30 g^2 /Hz
350 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 1.00 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.16 g^2 /Hz

Composite = 30.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2 /Hz
20 - 60 Hz @ +10 dB/oct
60 - 200 Hz @ 0.10 g^2 /Hz
200 - 350 Hz @ +9 dB/oct
350 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.080 g^2 /Hz

Composite = 22.9 g_{rms}

3-1-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.64 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 4.00 g^2 /Hz
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ 1.00 g^2 /Hz
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 4.00 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.19 g^2 /Hz

Composite = 58.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.18 g^2 /Hz
20 - 40 Hz @ +6 dB/oct
40 - 320 Hz @ 0.70 g^2 /Hz
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ 2.00 g^2 /Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.13 g^2 /Hz

Composite = 41.7 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-1-1-B Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034, X_t 941, and X_t 897 in Panels 1, 2, and 3 of the ET Intertank. Weight of Component ≥ 25 but < 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.16 g^2 /Hz
 20 - 35 Hz @ +6 dB/oct
 35 - 100 Hz @ 0.50 g^2 /Hz
 100 - 160 Hz @ -9 dB/oct
 160 - 320 Hz @ 0.12 g^2 /Hz
 320 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.50 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.023 g^2 /Hz

Composite = 20.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.045 g^2 /Hz
 20 - 28 Hz @ +6 dB/oct
 28 - 320 Hz @ 0.097 g^2 /Hz
 320 - 450 Hz @ +9 dB/oct
 450 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.016 g^2 /Hz

Composite = 14.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 78 Hz @ +6 dB/oct
 78 - 350 Hz @ 0.15 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.50 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.081 g^2 /Hz

Composite = 21.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2 /Hz
 20 - 48 Hz @ +10 dB/oct
 48 - 200 Hz @ 0.050 g^2 /Hz
 200 - 350 Hz @ +9 dB/oct
 350 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.040 g^2 /Hz

Composite = 16.2 g_{rms}

3-1-1-B (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.64 g^2/Hz$
20 - 35 Hz @ +6 dB/oct
35 - 100 Hz @ $2.00 g^2/Hz$
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ $0.50 g^2/Hz$
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $2.00 g^2/Hz$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.095 g^2/Hz$

Composite = $41.3 g_{rms}$

Long. and Tang. Axes

20 Hz @ $0.18 g^2/Hz$
20 - 28 Hz @ +6 dB/oct
28 - 320 Hz @ $0.35 g^2/Hz$
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ $1.00 g^2/Hz$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.065 g^2/Hz$

Composite = $29.5 g_{rms}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-1-1-C Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034, X_t 941, and X_t 897 in Panels 1, 2, and 3 of the ET Intertank. Weight of Component \geq 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.16 g^2 /Hz
 20 - 25 Hz @ +6 dB/oct
 25 - 100 Hz @ 0.25 g^2 /Hz
 100 - 160 Hz @ -9 dB/oct
 160 - 320 Hz @ 0.062 g^2 /Hz
 320 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.012 g^2 /Hz

Composite = 14.6 g_{rms}

Long. and Tang. Axes

20 - 320 Hz @ 0.042 g^2 /Hz
 320 - 450 Hz @ +9 dB/oct
 450 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0080 g^2 /Hz

Composite = 10.4 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 55 Hz @ +6 dB/oct
 55 - 350 Hz @ 0.075 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.040 g^2 /Hz

Composite = 15.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2 /Hz
 20 - 40 Hz @ +10 dB/oct
 40 - 200 Hz @ 0.025 g^2 /Hz
 200 - 350 Hz @ +9 dB/oct
 350 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2 /Hz

Composite = 11.5 g_{rms}

3-1-1-C (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.64 g^2/Hz$
20 - 25 Hz @ +6 dB/oct
25 - 100 Hz @ $1.00 g^2/Hz$
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ $0.25 g^2/Hz$
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $1.00 g^2/Hz$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.047 g^2/Hz$

Composite = $29.3 g_{rms}$

Long. and Tang. Axes

20 - 320 Hz @ $0.17 g^2/Hz$
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ $0.50 g^2/Hz$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.032 g^2/Hz$

Composite = $20.8 g_{rms}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-1-2 Structural Ring at Station X_t 985 in Panels 1, 2, and 3 of the ET Intertank (General Specifications)

Same as Subzone 3-1-2-A below.

Subzone 3-1-2-A Input to Components Mounted on Structural Ring at Station X_t 985 in Panels 1, 2, and 3 of the ET Intertank.
Weight of Component < 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.080 g^2 /Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 100 Hz @ 0.50 g^2 /Hz
 100 - 160 Hz @ -9 dB/oct
 160 - 320 Hz @ 0.12 g^2 /Hz
 320 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.50 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.023 g^2 /Hz

Composite = 20.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.022 g^2 /Hz
 20 - 40 Hz @ +6 dB/oct
 40 - 320 Hz @ 0.087 g^2 /Hz
 320 - 450 Hz @ +9 dB/oct
 450 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.016 g^2 /Hz

Composite = 14.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0050 g^2 /Hz
 20 - 110 Hz @ +6 dB/oct
 110 - 350 Hz @ 0.15 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.50 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.081 g^2 /Hz

Composite = 21.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
 20 - 60 Hz @ +10 dB/oct
 60 - 200 Hz @ 0.050 g^2 /Hz
 200 - 350 Hz @ +9 dB/oct
 350 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.040 g^2 /Hz

Composite = 16.2 g_{rms}

3-1-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.32 g^2/\text{Hz}$
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ $2.00 g^2/\text{Hz}$
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ $0.50 g^2/\text{Hz}$
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $2.00 g^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.095 g^2/\text{Hz}$

Composite = $41.1 g_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.090 g^2/\text{Hz}$
20 - 40 Hz @ +6 dB/oct
40 - 320 Hz @ $0.35 g^2/\text{Hz}$
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ $1.00 g^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.065 g^2/\text{Hz}$

Composite = $29.4 g_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-1-2-B Input to Components Mounted on Structural Ring at Station X_t 985 in Panels 1, 2, and 3 of the ET Intertank. Weight of Component ≥ 30 but < 90 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.080 g^2 /Hz
 20 - 35 Hz @ +6 dB/oct
 35 - 100 Hz @ 0.25 g^2 /Hz
 100 - 160 Hz @ -9 dB/oct
 160 - 320 Hz @ 0.062 g^2 /Hz
 320 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.012 g^2 /Hz

Composite = 14.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.022 g^2 /Hz
 20 - 28 Hz @ +6 dB/oct
 28 - 320 Hz @ 0.042 g^2 /Hz
 320 - 450 Hz @ +9 dB/oct
 450 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0080 g^2 /Hz

Composite = 10.4 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0050 g^2 /Hz
 20 - 78 Hz @ +6 dB/oct
 78 - 350 Hz @ 0.075 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.040 g^2 /Hz

Composite = 14.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
 20 - 42 Hz @ +10 dB/oct
 42 - 200 Hz @ 0.025 g^2 /Hz
 200 - 350 Hz @ +9 dB/oct
 350 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2 /Hz

Composite = 11.4 g_{rms}

3-1-2-B (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.32 g^2/\text{Hz}$
20 - 35 Hz @ +6 dB/oct
35 - 100 Hz @ $1.00 g^2/\text{Hz}$
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ $0.25 g^2/\text{Hz}$
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $1.00 g^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.047 g^2/\text{Hz}$

Composite = $29.2 g_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.090 g^2/\text{Hz}$
20 - 28 Hz @ +6 dB/oct
28 - 320 Hz @ $0.017 g^2/\text{Hz}$
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ $0.50 g^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.032 g^2/\text{Hz}$

Composite = $20.8 g_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-1-2-C Input to Components Mounted on Structural Ring at Station X_t 985 in Panels 1, 2, and 3 of the ET Intertank. Weight of Component ≥ 90 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.080 g^2 /Hz
 20 - 25 Hz @ +6 dB/oct
 25 - 100 Hz @ 0.12 g^2 /Hz
 100 - 160 Hz @ -9 dB/oct
 160 - 320 Hz @ 0.030 g^2 /Hz
 320 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.006 g^2 /Hz

Composite = 10.1 g_{rms}

Long. and Tang. Axes

20 - 320 Hz @ 0.021 g^2 /Hz
 320 - 450 Hz @ +9 dB/oct
 450 - 800 Hz @ 0.062 g^2 /Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0040 g^2 /Hz

Composite = 7.3 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0050 g^2 /Hz
 20 - 55 Hz @ +6 dB/oct
 55 - 350 Hz @ 0.037 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2 /Hz

Composite = 10.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
 20 - 30 Hz @ +10 dB/oct
 30 - 200 Hz @ 0.012 g^2 /Hz
 200 - 350 Hz @ +9 dB/oct
 350 - 800 Hz @ 0.060 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.010 g^2 /Hz

Composite = 8.1 g_{rms}

3-1-2-C (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.32 \text{ g}^2/\text{Hz}$
20 - 25 Hz @ +6 dB/oct
25 - 100 Hz @ $0.50 \text{ g}^2/\text{Hz}$
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ $0.12 \text{ g}^2/\text{Hz}$
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $0.50 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.023 \text{ g}^2/\text{Hz}$

Composite = $20.7 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 320 Hz @ $0.085 \text{ g}^2/\text{Hz}$
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ $0.25 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.016 \text{ g}^2/\text{Hz}$

Composite = $14.7 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-2 ET Intertank (Stations X_t 1130 to X_t 852) Panels 4 and 5.
(General Specifications)

Same as Subzone 3-2-1-A below.

Subzone 3-2-1 Structural Rings at Stations X_t 1082, X_t 1034, X_t 941,
And X_t 897 in Panels 4 and 5 of the ET Intertank.
(General Specifications)

Same as Subzone 3-2-1-A below.

Subzone 3-2-1-A Input to Components Mounted on Structural Rings at
Stations X_t 1082, X_t 1034, X_t 941 and X_t 897, in
Panels 4 and 5 of the ET Intertank. Weight of
Components < 50 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 340 Hz @ 0.16 g^2/Hz
340 - 515 Hz @ +10 dB/oct
515 - 800 Hz @ 0.62 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.040 g^2/Hz

Composite = 22.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.017 g^2/Hz
20 - 30 Hz @ +6 dB/oct
30 - 200 Hz @ 0.038 g^2/Hz
200 - 415 Hz @ +10 dB/oct
415 - 800 Hz @ 0.42 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.028 g^2/Hz

Composite = 18.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0058 g^2/Hz
20 - 120 Hz @ +4 dB/oct
120 - 330 Hz @ 0.062 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.25 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.040 g^2/Hz

Composite = 15.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0011 g^2/Hz
20 - 60 Hz @ +9 dB/oct
60 - 230 Hz @ 0.029 g^2/Hz
230 - 360 Hz @ +10 dB/oct
360 - 2000 Hz @ 0.12 g^2/Hz

Composite = 14.8 g_{rms}

3-2-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.071 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 340 Hz @ 0.62 g^2/Hz
340 - 515 Hz @ +10 dB/oct
515 - 800 Hz @ 2.50 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.16 g^2/Hz

Composite = 44.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.067 g^2/Hz
20 - 30 Hz @ +6 dB/oct
30 - 200 Hz @ 0.15 g^2/Hz
200 - 415 Hz @ +10 dB/oct
415 - 800 Hz @ 1.67 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.11 g^2/Hz

Composite = 37.2 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

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Subzone 3-2-1-B Input to Components Mounted on Structural Rings At Stations X_t 1082, X_t 1034, X_t 941 and X_t 897, in Panels 4 and 5 of the ET Intertank. Weight of Component ≥ 50 but < 150 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g^2/Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 340 Hz @ 0.078 g^2/Hz
 340 - 515 Hz @ +10 dB/oct
 515 - 800 Hz @ 0.30 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 15.8 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.019 g^2/Hz
 200 - 415 Hz @ +10 dB/oct
 415 - 800 Hz @ 0.21 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.014 g^2/Hz

Composite 13.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0037 g^2/Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 330 Hz @ 0.031 g^2/Hz
 330 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.12 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 10.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0010 g^2/Hz
 20 - 48 Hz @ +9 dB/oct
 48 - 230 Hz @ 0.015 g^2/Hz
 230 - 360 Hz @ +10 dB/oct
 360 - 2000 Hz @ 0.062 g^2/Hz

Composite = 10.5 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.071 g^2/Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 340 Hz @ 0.31 g^2/Hz
 340 - 515 Hz @ +10 dB/oct
 515 - 800 Hz @ 1.20 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.079 g^2/Hz

Composite = 31.6 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.075 g^2/Hz
 200 - 415 Hz @ +10 dB/oct
 415 - 800 Hz @ 0.83 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.054 g^2/Hz

Composite = 26.3 g_{rms}

3-2-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*

5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*

5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-2-1-C Input to Components Mounted on Structural Rings At Stations X_t 1082, X_t 1034, X_t 941 and X_t 897, in Panels 4 and 5 of the ET Intertank. Weight of Components \geq 150 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.018 g^2/Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 340 Hz @ 0.040 g^2/Hz
 340 - 515 Hz @ +10 dB/oct
 515 - 800 Hz @ 0.16 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 11.2 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.0095 g^2/Hz
 200 - 415 Hz @ +10 dB/oct
 415 - 800 Hz @ 0.11 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0068 g^2/Hz

Composite = 9.3 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0028 g^2/Hz
 20 - 75 Hz @ +4 dB/oct
 75 - 330 Hz @ 0.016 g^2/Hz
 330 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.062 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 7.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0010 g^2/Hz
 20 - 38 Hz @ +9 dB/oct
 38 - 230 Hz @ 0.0075 g^2/Hz
 230 - 360 Hz @ +10 dB/oct
 360 - 2000 Hz @ 0.031 g^2/Hz

Composite = 7.4 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.071 g^2/Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 340 Hz @ 0.16 g^2/Hz
 340 - 515 Hz @ +10 dB/oct
 515 - 800 Hz @ 0.62 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.040 g^2/Hz

Composite = 22.4 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.038 g^2/Hz
 200 - 415 Hz @ +10 dB/oct
 415 - 800 Hz @ 0.42 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.027 g^2/Hz

Composite = 18.6 g_{rms}

3-2-1-C (Cont.)

4. Vehicle Dynamics Criteria .

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 3-2-2 Structural Ring at Station X_t 985 in Panels 4 and 5 of
The ET Intertank. (General Specifications)**

Same as Subzone 3-2-2-A below.

**Subzone 3-2-2-A Input to Components Mounted on Structural Ring At
Station X_t 985 in Panels 4 and 5 of the ET Intertank.
Weight of Components < 75 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0048 g²/Hz
20 - 60 Hz @ +6 dB/oct
60 - 330 Hz @ 0.042 g²/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.17 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.011 g²/Hz

Composite = 11.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0042 g²/Hz
20 - 30 Hz @ +6 dB/oct
30 - 200 Hz @ 0.0095 g²/Hz
200 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.11 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0072 g²/Hz

Composite = 9.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0016 g²/Hz
20 - 120 Hz @ +4 dB/oct
120 - 330 Hz @ 0.018 g²/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.070 g²/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.011 g²/Hz

Composite = 3.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00030 g²/Hz
20 - 60 Hz @ +9 dB/oct
60 - 230 Hz @ 0.0080 g²/Hz
230 - 360 Hz @ +10 dB/oct
360 - 2000 Hz @ 0.035 g²/Hz

Composite = 7.9 g_{rms}

3-2-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 330 Hz @ 0.17 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.67 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.045 g^2/Hz

Composite = 23.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.017 g^2/Hz
20 - 30 Hz @ +6 dB/oct
30 - 200 Hz @ 0.038 g^2/Hz
200 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.45 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.029 g^2/Hz

Composite = 19.2 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 3-2-2-B Input to Components Mounted on Structural Ring At
Station X_t 985 in panels 4 and 5 of the ET Intertank.
Weight of Components ≥ 75 but < 225 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0048 g^2/Hz
20 - 42 Hz @ +6 dB/oct
42 - 330 Hz @ 0.021 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.080 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0052 g^2/Hz

Composite = 8.0 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.0048 g^2/Hz
200 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.055 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0035 g^2/Hz

Composite = 6.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0011 g^2/Hz
20 - 100 Hz @ +4 dB/oct
100 - 330 Hz @ 0.0090 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.035 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 5.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00030 g^2/Hz
20 - 48 Hz @ +9 dB/oct
48 - 230 Hz @ 0.0038 g^2/Hz
230 - 360 Hz @ +10 dB/oct
360 - 2000 Hz @ 0.018 g^2/Hz

Composite = 5.5 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
20 - 42 Hz @ +6 dB/oct
42 - 330 Hz @ 0.083 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.32 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.021 g^2/Hz

Composite = 16.1 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.019 g^2/Hz
200 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.22 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.014 g^2/Hz

Composite = 13.6 g_{rms}

3-2-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 3-2-2-C Input to Components Mounted on Structural Ring At
Station X_t 985 in Panels 4 and 5 of the ET Intertank.
Weight of Components \geq 225 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0048 g²/Hz
20 - 30 Hz @ +6 dB/oct
30 - 330 Hz @ 0.011 g²/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.040 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0025 g²/Hz

Composite = 5.7 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.0024 g²/Hz
200 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.028 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0018 g²/Hz

Composite = 4.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0012 g²/Hz
20 - 75 Hz @ +4 dB/oct
75 - 330 Hz @ 0.0068 g²/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.026 g²/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0042 g²/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00030 g²/Hz
20 - 38 Hz @ +9 dB/oct
38 - 230 Hz @ 0.0032 g²/Hz
230 - 360 Hz @ +10 dB/oct
360 - 2000 Hz @ 0.014 g²/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.019 g²/Hz
20 - 30 Hz @ +6 dB/oct
30 - 330 Hz @ 0.042 g²/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.16 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.010 g²/Hz

Composite = 11.4 g_{rms}

Long. and Tang. Axes

20 - 200 Hz @ 0.0096 g²/Hz
200 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.11 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0074 g²/Hz

Composite = 9.6 g_{rms}

3-2-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-2-3 SRB Beam at Station X_t 985 of the ET Intertank.
(General Specifications)

Same as Subzone 3-2-3-A below.

Subzone 3-2-3-A Input to Components Mounted on the SRB Beam At
Station X_t 985 of the ET Intertank.

1. Acceptance Test Criteria (1 min/axis)

X_t and Z_t Axes

20 Hz @ 0.0021 g^2/Hz
20 - 40 Hz @ +9 dB/oct
40 - 120 Hz @ 0.019 g^2/Hz
120 - 160 Hz @ -9 dB/oct
160 - 310 Hz @ 0.0080 g^2/Hz
310 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.022 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 5.5 g_{rms}

Y_t Axis

20 Hz @ 0.00095 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 330 Hz @ 0.0085 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.032 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0022 g^2/Hz

Composite = 5.2 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

X_t and Z_t Axes

20 Hz @ 0.00077 g^2/Hz
20 - 65 Hz @ +9 dB/oct
65 - 160 Hz @ 0.026 g^2/Hz
160 - 360 Hz @ -3 dB/oct
360 - 2000 Hz @ 0.012 g^2/Hz

Composite = 5.0 g_{rms}

Y_t Axis

20 Hz @ 0.00064 g^2/Hz
20 - 120 Hz @ +4 dB/oct
120 - 330 Hz @ 0.0066 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.027 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0043 g^2/Hz

Composite = 5.0 g_{rms}

3-2-3-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

X_t and Z_t Axes

20 Hz @ 0.0085 g^2/Hz
20 - 40 Hz @ +9 dB/oct
40 - 120 Hz @ 0.076 g^2/Hz
120 - 160 Hz @ -9 dB/oct
160 - 310 Hz @ 0.032 g^2/Hz
310 - 420 Hz @ +10 dB/oct
420 - 800 Hz @ 0.090 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 11.0 g_{rms}

Y_t Axis

20 Hz @ 0.0038 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 330 Hz @ 0.034 g^2/Hz
330 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.13 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0090 g^2/Hz

Composite = 10.4 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

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Subzone 3-3 ET Intertank (Stations X_t 1130 to X_t 852), Panels 6, 7, and 8 (General Specifications)

Same as Subzone 3-3-1-A below.

Subzone 3-3-1 Structural Rings at Stations X_t 1082, X_t 1034 (Partial), X_t 941, and X_t 897 in Panels 6, 7, and 8 of the ET Intertank (General Specifications)

Same as Subzone 3-3-1-A below.

Subzone 3-3-1-A Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034 (Partial), X_t 941 and X_t 897 in Panels 6, 7, and 8 of the ET Intertank. Weight of Component < 25 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.0080 \text{ g}^2/\text{Hz}$
20 - 50 Hz @ +9 dB/oct
50 - 290 Hz @ $0.12 \text{ g}^2/\text{Hz}$
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ $0.3 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.018 \text{ g}^2/\text{Hz}$
Composite = $17.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0030 \text{ g}^2/\text{Hz}$
20 - 60 Hz @ +6 dB/oct
60 - 260 Hz @ $0.025 \text{ g}^2/\text{Hz}$
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $0.17 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.0085 \text{ g}^2/\text{Hz}$
Composite = $11.4 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.010 \text{ g}^2/\text{Hz}$
20 - 110 Hz @ +6 dB/oct
110 - 350 Hz @ $0.30 \text{ g}^2/\text{Hz}$
350 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ $1.00 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.16 \text{ g}^2/\text{Hz}$
Composite = $30.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0020 \text{ g}^2/\text{Hz}$
20 - 70 Hz @ +9 dB/oct
70 - 170 Hz @ $0.090 \text{ g}^2/\text{Hz}$
170 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ $0.50 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.094 \text{ g}^2/\text{Hz}$
Composite = $22.0 \text{ g}_{\text{rms}}$

3-3-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.031 g^2 /Hz
20 - 50 Hz @ +9 dB/oct
50 - 290 Hz @ 0.50 g^2 /Hz
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ 1.50 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.074 g^2 /Hz

Composite = 35.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2 /Hz
20 - 60 Hz @ +6 dB/oct
60 - 260 Hz @ 0.10 g^2 /Hz
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.70 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.034 g^2 /Hz

Composite = 22.9 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's Peak*
5 - 40 Hz @ 0.6 G's Peak

Lateral Axes

2 - 5 Hz @ 0.8 G's Peak*
5 - 40 Hz @ 0.8 G's Peak

5. Shock Test Criteria

See Table I

* Design Criteria Only

Subzone 3-3-1-B Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034 (Partial), X_t 941 and X_t 897 on Panels 6, 7, and 8 of the ET Inter tank. Weight of Component ≥ 25 but < 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0080 g^2 /Hz
 20 - 40 Hz @ +9 dB/oct
 40 - 290 Hz @ 0.063 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.19 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0010 g^2 /Hz

Composite = 12.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0030 g^2 /Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 260 Hz @ 0.013 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.088 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0043 g^2 /Hz

Composite = 8.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 78 Hz @ +6 dB/oct
 78 - 350 Hz @ 0.15 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.50 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.080 g^2 /Hz

Composite = 21.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0020 g^2 /Hz
 20 - 56 Hz @ +9 dB/oct
 56 - 170 Hz @ 0.045 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.047 g^2 /Hz

Composite = 15.6 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.031 g^2 /Hz
 20 - 40 Hz @ +9 dB/oct
 40 - 290 Hz @ 0.25 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.75 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.037 g^2 /Hz

Composite = 24.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2 /Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 260 Hz @ 0.050 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.35 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.017 g^2 /Hz

Composite = 16.2 g_{rms}

3-3-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-3-1-C Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034 (Partial), X_t 941, and X_t 897 in Panels 6, 7, and 8 of the ET Intertank.
 Weight of Component ≥ 75 lb. but < 225 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0080 g^2 /Hz
 20 - 32 Hz @ +9 dB/oct
 32 - 290 Hz @ 0.033 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.095 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0050 g^2 /Hz

Composite = 8.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0030 g^2 /Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 260 Hz @ 0.0063 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.045 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0023 g^2 /Hz

Composite = 5.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 55 Hz @ +6 dB/oct
 55 - 350 Hz @ 0.075 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.040 g^2 /Hz

Composite = 15.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0020 g^2 /Hz
 20 - 45 Hz @ +9 dB/oct
 45 - 170 Hz @ 0.023 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.13 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.024 g^2 /Hz

Composite = 11.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.031 g^2 /Hz
 20 - 32 Hz @ +9 dB/oct
 32 - 290 Hz @ 0.13 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.38 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.019 g^2 /Hz

Composite = 17.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2 /Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 260 Hz @ 0.025 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.18 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0090 g^2 /Hz

Composite = 11.6 g_{rms}

3-3-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only . _____

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Subzone 3-3-1-D Input to Components Mounted on Structural Rings at Stations X_t 1082, X_t 1034 (Partial), X_t 941, and X_t 897 in Panels 6, 7, and 8 of the ET Intertank.
 Weight of Component \geq 225 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0080 g^2 /Hz
 20 - 26 Hz @ +9 dB/oct
 26 - 290 Hz @ 0.016 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.048 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0023 g^2 /Hz

Composite = 6.2 g_{rms}

Long. and Tang. Axes

20 - 260 Hz @ 0.0033 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.023 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0011 g^2 /Hz

Composite = 4.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 39 Hz @ +6 dB/oct
 39 - 350 Hz @ 0.038 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2 /Hz

Composite = 11.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0020 g^2 /Hz
 20 - 37 Hz @ +9 dB/oct
 37 - 170 Hz @ 0.012 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.065 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.012 g^2 /Hz

Composite = 7.6 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.031 g^2 /Hz
 20 - 26 Hz @ +9 dB/oct
 26 - 290 Hz @ 0.065 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.19 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0090 g^2 /Hz

Composite = 12.5 g_{rms}

Long. and Tang. Axes

20 - 260 Hz @ 0.013 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.090 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0045 g^2 /Hz

Composite = 8.2 g_{rms}

3-3-1-D (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's Peak*
5 - 40 Hz @ 0.6 G's Peak

Lateral Axes

2 - 5 Hz @ 0.8 G's Peak*
5 - 40 Hz @ 0.8 G's Peak

5. Shock Test Criteria

See Table I

* Design Criteria Only

**Subzone 3-3-2 Structural Ring at Station X_t 985 in Panels 6, 7, and 8
of the ET Intertank (General Specifications)**

Same as Subzone 3-3-2-A below.

**Subzone 3-3-2-A Input to Components Mounted on the Structural Ring
at Station X_t 985 in Panels 6, 7, and 8 of the ET
Intertank. Weight of Component < 35 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g²/Hz
20 - 50 Hz @ +9 dB/oct
50 - 290 Hz @ 0.043 g²/Hz
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ 0.13 g²/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0065 g²/Hz

Composite = 10.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0010 g²/Hz
20 - 60 Hz @ +6 dB/oct
60 - 260 Hz @ 0.0090 g²/Hz
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.060 g²/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0030 g²/Hz

Composite = 6.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0034 g²/Hz
20 - 110 Hz @ +6 dB/oct
110 - 350 Hz @ 0.10 g²/Hz
350 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.34 g²/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.058 g²/Hz

Composite = 17.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00070 g²/Hz
20 - 70 Hz @ +9 dB/oct
70 - 170 Hz @ 0.031 g²/Hz
170 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.17 g²/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.028 g²/Hz

Composite = 13.1 g_{rms}

3-3-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
20 - 50 Hz @ +9 dB/oct
50 - 290 Hz @ 0.17 g^2 /Hz
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.025 g^2 /Hz

Composite = 20.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0041 g^2 /Hz
20 - 60 Hz @ +6 dB/oct
60 - 260 Hz @ 0.034 g^2 /Hz
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.24 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.012 g^2 /Hz

Composite = 13.4 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's Peak*
5 - 40 Hz @ 0.6 G's Peak

Lateral Axes

2 - 5 Hz @ 0.8 G's Peak*
5 - 40 Hz @ 0.8 G's Peak

5. Shock Test Criteria

See Table I

* Design Criteria Only.

Subzone 3-3-2-B Input to Components Mounted on the Structural Ring at Station X_t 985 in Panels 6, 7, and 8 of the ET Intertank. Weight of Component ≥ 35 but < 100 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2 /Hz
 20 - 41 Hz @ +9 dB/oct
 41 - 290 Hz @ 0.021 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.061 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0030 g^2 /Hz

Composite = 7.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0010 g^2 /Hz
 20 - 43 Hz @ +6 dB/oct
 43 - 260 Hz @ 0.0043 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.030 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0015 g^2 /Hz

Composite = 4.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0034 g^2 /Hz
 20 - 78 Hz @ +6 dB/oct
 78 - 350 Hz @ 0.050 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.17 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.029 g^2 /Hz

Composite = 12.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00070 g^2 /Hz
 20 - 56 Hz @ +9 dB/oct
 56 - 170 Hz @ 0.016 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.085 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.014 g^2 /Hz

Composite = 9.3 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 41 Hz @ +9 dB/oct
 41 - 290 Hz @ 0.085 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.25 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.012 g^2 /Hz

Composite = 14.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0041 g^2 /Hz
 20 - 43 Hz @ +6 dB/oct
 43 - 260 Hz @ 0.017 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0060 g^2 /Hz

Composite = 9.5 g_{rms}

3-3-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's Peak*
5 - 40 Hz @ 0.6 G's Peak

Lateral Axes

2 - 5 Hz @ 0.8 G's Peak*
5 - 40 Hz @ 0.8 G's Peak

5. Shock Test Criteria

See Table I

* Design Criteria Only

Subzone 3-3-2-C Input to Components Mounted on the Structural Ring
at Station X_t 985 in Panels 6, 7, and 8 of the ET
Intertank. Weight of Component \geq 100 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2 /Hz
 20 - 33 Hz @ +9 dB/oct
 33 - 290 Hz @ 0.011 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.033 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0016 g^2 /Hz

Composite = 5.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0010 g^2 /Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 260 Hz @ 0.0020 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.015 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.00075 g^2 /Hz

Composite = 3.3 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0034 g^2 /Hz
 20 - 54 Hz @ +6 dB/oct
 54 - 350 Hz @ 0.025 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.085 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.015 g^2 /Hz

Composite = 8.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00070 g^2 /Hz
 20 - 45 Hz @ +9 dB/oct
 45 - 170 Hz @ 0.0080 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.043 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0070 g^2 /Hz

Composite = 6.6 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
 20 - 33 Hz @ +9 dB/oct
 33 - 290 Hz @ 0.043 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.13 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0065 g^2 /Hz

Composite = 10.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0041 g^2 /Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 260 Hz @ 0.0085 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.060 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0030 g^2 /Hz

Composite = 6.7 g_{rms}

3-3-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

*** Design Criteria Only**

Subzone 3-3-3 Structural Ring at Station X_t 1034 Between the -Z Axis and the Access Door of the ET Intertank (General Specifications)

Same as Subzone 3-3-3-A below.

Subzone 3-3-3-A Input to Components Mounted on the Structural Ring at Station X_t 1034 Between the -Z Axis and the Access Door of the ET Intertank. Weight of Component < 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0050 g²/Hz
 20 - 50 Hz @ +9 dB/oct
 50 - 290 Hz @ 0.080 g²/Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.24 g²/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.012 g²/Hz

Composite = 13.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0019 g²/Hz
 20 - 60 Hz @ +6 dB/oct
 60 - 260 Hz @ 0.016 g²/Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.11 g²/Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0055 g²/Hz

Composite = 9.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0064 g²/Hz
 20 - 110 Hz @ +6 dB/oct
 110 - 350 Hz @ 0.19 g²/Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.63 g²/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.10 g²/Hz

Composite = 24.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g²/Hz
 20 - 70 Hz @ +9 dB/oct
 70 - 170 Hz @ 0.060 g²/Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.32 g²/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.052 g²/Hz

Composite = 18.1 g_{rms}

3-3-3-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ $0.021 \text{ g}^2/\text{Hz}$
20 - 50 Hz @ +9 dB/oct
50 - 290 Hz @ $0.32 \text{ g}^2/\text{Hz}$
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ $0.95 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.047 \text{ g}^2/\text{Hz}$

Composite = 27.8

Long. and Tang. Axes

20 Hz @ $0.0074 \text{ g}^2/\text{Hz}$
20 - 60 Hz @ +6 dB/oct
60 - 260 Hz @ $0.063 \text{ g}^2/\text{Hz}$
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ $0.44 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ $0.022 \text{ g}^2/\text{Hz}$

Composite = $18.2 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Later al Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria

See Table I

* Design Criteria Only.

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Subzone 3-3-3-B Input to Components Mounted on the Structural Ring at Station X_t 1034 Between the -Z Axis and the Access Door of the ET Intertank. Weight of Component \geq 30 but $<$ 90 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0050 g^2 /Hz
 20 - 40 Hz @ +9 dB/oct
 40 - 290 Hz @ 0.040 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.12 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0060 g^2 /Hz

Composite = 9.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0019 g^2 /Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 260 Hz @ 0.0080 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.055 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0028 g^2 /Hz

Composite = 6.4 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0064 g^2 /Hz
 20 - 78 Hz @ +6 dB/oct
 78 - 350 Hz @ 0.095 g^2 /Hz
 350 - 500 Hz @ +10 dB/oct
 500 - 800 Hz @ 0.32 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.050 g^2 /Hz

Composite = 17.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
 20 - 56 Hz @ +9 dB/oct
 56 - 170 Hz @ 0.030 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.16 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.026 g^2 /Hz

Composite = 12.8 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.021 g^2 /Hz
 20 - 40 Hz @ +9 dB/oct
 40 - 290 Hz @ 0.16 g^2 /Hz
 290 - 500 Hz @ +6 dB/oct
 500 - 800 Hz @ 0.49 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.024 g^2 /Hz

Composite = 19.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0074 g^2 /Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 260 Hz @ 0.032 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.22 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.011 g^2 /Hz

Composite = 12.8 g_{rms}

3-3-3-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria

See Table I

* Design Criteria Only

Subzone 3-3-3-C Input to Components Mounted on the Structural Ring
at Station X_t 1034 Between the -Z Axis and the Access
Door of the ET Intertank. Weight of Component ≥
90 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0050 g^2 /Hz
20 - 31 Hz @ +9 dB/oct
31 - 290 Hz @ 0.020 g^2 /Hz
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ 0.060 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0030 g^2 /Hz

Composite = 7.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0019 g^2 /Hz
20 - 30 Hz @ +6 dB/oct
30 - 260 Hz @ 0.0040 g^2 /Hz
260 - 500 Hz @ -1 dB/oct
500 - 800 Hz @ 0.028 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0014 g^2 /Hz

Composite = 4.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0064 g^2 /Hz
20 - 56 Hz @ +6 dB/oct
56 - 350 Hz @ 0.048 g^2 /Hz
350 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 0.16 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.025 g^2 /Hz

Composite = 12.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
20 - 44 Hz @ +9 dB/oct
44 - 170 Hz @ 0.015 g^2 /Hz
170 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.080 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.013 g^2 /Hz

Composite = 9.1 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.021 g^2 /Hz
20 - 31 Hz @ +9 dB/oct
31 - 290 Hz @ 0.080 g^2 /Hz
290 - 500 Hz @ +6 dB/oct
500 - 800 Hz @ 0.24 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.012 g^2 /Hz

Composite = 14.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0074 g^2 /Hz
20 - 30 Hz @ +6 dB/oct
30 - 260 Hz @ 0.016 g^2 /Hz
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.11 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0055 g^2 /Hz

Composite = 9.1 g_{rms}

3-3-3-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria

See Table I

* Design Criteria Only

Subzone 3-3-3-1 Input to Components Mounted on the Development
Flight Instrumentation (DFI) Panels in the
ET Intertank

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.033 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 0.20 g^2 /Hz
100 - 185 Hz @ -6 dB/oct
185 - 800 Hz @ 0.060 g^2 /Hz
800 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.0060 g^2 /Hz

Composite = 8.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0019 g^2 /Hz
20 - 30 Hz @ +6 dB/oct
30 - 260 Hz @ 0.0040 g^2 /Hz
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.028 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0014 g^2 /Hz

Composite = 4.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.080 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 0.50 g^2 /Hz
100 - 175 Hz @ -6 dB/oct
175 - 800 Hz @ 0.16 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.025 g^2 /Hz

Composite = 15.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
20 - 44 Hz @ +9 dB/oct
44 - 170 Hz @ 0.015 g^2 /Hz
170 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.080 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.013 g^2 /Hz

Composite = 9.1 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.13 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 0.80 g^2 /Hz
100 - 185 Hz @ -6 dB/oct
185 - 800 Hz @ 0.24 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.012 g^2 /Hz

Composite = 17.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0074 g^2 /Hz
20 - 30 Hz @ +6 dB/oct
30 - 260 Hz @ 0.016 g^2 /Hz
260 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.11 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.0055 g^2 /Hz

Composite = 9.1 g_{rms}

3-3-3-1 (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*

5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*

5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-3-3-2 Input to Components Mounted on the Range Safety System (RSS) Panel in the ET Intertank

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.011 g^2 /Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 170 Hz @ 0.25 g^2 /Hz
 170 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.023 g^2 /Hz

Composite = 11.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0019 g^2 /Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 260 Hz @ 0.0080 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.055 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.0028 g^2 /Hz

Composite = 6.4 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0072 g^2 /Hz
 20 - 100 Hz @ +9 dB/oct
 100 - 170 Hz @ 0.95 g^2 /Hz
 170 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.082 g^2 /Hz

Composite = 22.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
 20 - 56 Hz @ +9 dB/oct
 56 - 170 Hz @ 0.030 g^2 /Hz
 170 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.16 g^2 /Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.026 g^2 /Hz

Composite = 12.8 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.042 g^2 /Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 170 Hz @ 1.00 g^2 /Hz
 170 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.090 g^2 /Hz

Composite = 22.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0074 g^2 /Hz
 20 - 42 Hz @ +6 dB/oct
 42 - 260 Hz @ 0.032 g^2 /Hz
 260 - 500 Hz @ +9 dB/oct
 500 - 800 Hz @ 0.22 g^2 /Hz
 800 - 2000 Hz @ -10 dB/oct
 2000 Hz @ 0.011 g^2 /Hz

Composite = 12.8 g_{rms}

3-3-3-2 (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*

5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*

5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 3-4 ET LH₂ Forward Bulkhead (General Specifications)

Same as Subzone 3-4-1-A below.

Subzone 3-4-1 ET LH₂ Forward Bulkhead Gores (Stations X_t 1130 to X_t 1108). (General Specifications)

Same as Subzone 3-4-1-A below.

Subzone 3-4-1-A Input to Components Mounted on the ET LH₂ Forward Bulkhead Gores (Stations X_t 1130 to X_t 1008). Weight of Component < 10 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0080 g²/Hz
20 - 120 Hz @ +9 dB/oct
120 - 400 Hz @ 1.75 g²/Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.072 g²/Hz

Composite = 33.2 g_{rms}

Directions B and C

20 Hz @ 0.017 g²/Hz
20 - 35 Hz @ +6 dB/oct
35 - 250 Hz @ 0.050 g²/Hz
250 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.12 g²/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.012 g²/Hz

Composite = 11.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0090 g²/Hz
20 - 140 Hz @ +9 dB/oct
140 - 400 Hz @ 2.80 g²/Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.11 g²/Hz

Composite = 41.5 g_{rms}

Directions B and C

20 - 180 Hz @ 0.050 g²/Hz
180 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.25 g²/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.021 g²/Hz

Composite = 16.0 g_{rms}

3-4-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.032 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +9 dB/oct
120 - 400 Hz @ $7.00 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.29 \text{ g}^2/\text{Hz}$

Composite = $66.3 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.066 \text{ g}^2/\text{Hz}$
20 - 35 Hz @ +6 dB/oct
35 - 250 Hz @ $0.20 \text{ g}^2/\text{Hz}$
250 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ $0.50 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.042 \text{ g}^2/\text{Hz}$

Composite = $23.0 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

**Subzone 3-4-1-B Input to Components Mounted on the ET LH₂
Forward Bulkhead Gores (Stations X_t 1130
to X_t 1008). Weight of Component ≥ 10
but < 30 lb.**

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0080 g^2 /Hz
20 - 96 Hz @ +9 dB/oct
96 - 400 Hz @ 0.87 g^2 /Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.035 g^2 /Hz

Composite = 23.8 g_{rms}

Directions B and C

20 Hz @ 0.017 g^2 /Hz
20 - 25 Hz @ +6 dB/oct
25 - 250 Hz @ 0.025 g^2 /Hz
250 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.061 g^2 /Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0055 g^2 /Hz

Composite = 8.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0090 g^2 /Hz
20 - 110 Hz @ +9 dB/oct
110 - 400 Hz @ 1.40 g^2 /Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.055 g^2 /Hz

Composite = 29.9 g_{rms}

Directions B and C

20 - 180 Hz @ 0.025 g^2 /Hz
180 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.12 g^2 /Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.011 g^2 /Hz

Composite = 11.3 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.032 g^2 /Hz
20 - 96 Hz @ +9 dB/oct
96 - 400 Hz @ 3.50 g^2 /Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.14 g^2 /Hz

Composite = 47.6 g_{rms}

Directions B and C

20 Hz @ 0.066 g^2 /Hz
20 - 25 Hz @ +6 dB/oct
25 - 250 Hz @ 0.10 g^2 /Hz
250 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.25 g^2 /Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.22 g^2 /Hz

Composite = 16.2 g_{rms}

3-4-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 3-4-1-C Input to Components Mounted on the ET LH₂
Forward Bulkhead Gores (Stations X_t 1130
to X_t 1008). Weight of Components ≥ 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0080 g²/Hz
 20 - 77 Hz @ +9 dB/oct
 77 - 400 Hz @ 0.44 g²/Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.017 g²/Hz

Composite = 16.8 g_{rms}

Directions B and C

20 - 250 Hz @ 0.012 g²/Hz
 250 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.030 g²/Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0027 g²/Hz

Composite = 5.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0090 g²/Hz
 20 - 87 Hz @ +9 dB/oct
 87 - 400 Hz @ 0.70 g²/Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0027 g²/Hz

Composite = 21.1 g_{rms}

Directions B and C

20 - 180 Hz @ 0.012 g²/Hz
 180 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.060 g²/Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.011 g²/Hz

Composite = 8.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.032 g²/Hz
 20 - 77 Hz @ +9 dB/oct
 77 - 400 Hz @ 1.75 g²/Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.070 g²/Hz

Composite = 33.6 g_{rms}

Directions B and C

20 - 250 Hz @ 0.050 g²/Hz
 250 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.12 g²/Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.11 g²/Hz

Composite = 11.4 g_{rms}

3-4-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

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Subzone 3-4-2 ET LH₂ Forward Bulkhead Cap (Station X_t 1008)
(General Specifications)

Same as Subzone 3-4-2-A below.

Subzone 3-4-2-A Input to Components Mounted on the ET LH₂
Forward Bulkhead Cap (Station X_t 1008).
Weight of Component < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0033 g²/Hz
20 - 120 Hz @ +9 dB/oct
120 - 400 Hz @ 0.72 g²/Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.028 g²/Hz

Composite = 21.4 g_{rms}

Directions B and C

20 Hz @ 0.0070 g²/Hz
20 - 35 Hz @ +6 dB/oct
35 - 250 Hz @ 0.020 g²/Hz
250 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.050 g²/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0040 g²/Hz

Composite = 7.2 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0050 g²/Hz
20 - 140 Hz @ +9 dB/oct
140 - 400 Hz @ 1.20 g²/Hz
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.045 g²/Hz

Composite = 27.3 g_{rms}

Directions B and C

20 - 180 Hz @ 0.020 g²/Hz
180 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ 0.10 g²/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0095 g²/Hz

Composite = 10.0 g_{rms}

3-4-2-A (Cont.)

5. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.013 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +9 dB/oct
120 - 400 Hz @ $2.90 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.11 \text{ g}^2/\text{Hz}$

Composite = $42.9 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.027 \text{ g}^2/\text{Hz}$
20 - 35 Hz @ +6 dB/oct
35 - 250 Hz @ $0.080 \text{ g}^2/\text{Hz}$
250 - 400 Hz @ +6 dB/oct
400 - 900 Hz @ $0.20 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.017 \text{ g}^2/\text{Hz}$

Composite = $14.5 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 3-4-2-B Input to Components Mounted on the ET LH₂
Forward Bulkhead Cap (Station X_t 1008).
 Weight of Component ≥ 20 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0033 g^2 /Hz
 20 - 95 Hz @ +9 dB/oct
 95 - 400 Hz @ 0.36 g^2 /Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.014 g^2 /Hz

Composite = 15.4 g_{rms}

Directions Band C

20 Hz @ 0.0070 g^2 /Hz
 20 - 25 Hz @ +6 dB/oct
 25 - 250 Hz @ 0.010 g^2 /Hz
 250 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.025 g^2 /Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0020 g^2 /Hz

Composite = 5.1 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0050 g^2 /Hz
 20 - 110 Hz @ +9 dB/oct
 110 - 400 Hz @ 0.60 g^2 /Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.023 g^2 /Hz

Composite = 19.6 g_{rms}

Directions B and C

20 - 260 Hz @ 0.020 g^2 /Hz
 260 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.050 g^2 /Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0040 g^2 /Hz

Composite = 7.3 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.013 g^2 /Hz
 20 - 95 Hz @ +9 dB/oct
 95 - 400 Hz @ 1.45 g^2 /Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.055 g^2 /Hz

Composite = 30.8 g_{rms}

Directions B and C

20 Hz @ 0.027 g^2 /Hz
 20 - 25 Hz @ +6 dB/oct
 25 - 250 Hz @ 0.040 g^2 /Hz
 250 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.10 g^2 /Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0085 g^2 /Hz

Composite = 10.3 g_{rms}

3-4-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 3-4-2-C Input to Components Mounted on the ET LH₂
Forward Bulkhead Cap (Station X_t 1008).
 Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0033 g^2 /Hz
 20 - 76 Hz @ +9 dB/oct
 76 - 400 Hz @ 0.18 g^2 /Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0075 g^2 /Hz

Composite = 10.9 g_{rms}

Directions B and C

20 - 290 Hz @ 0.0070 g^2 /Hz
 290 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.012 g^2 /Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0016 g^2 /Hz

Composite = 3.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0050 g^2 /Hz
 20 - 90 Hz @ +9 dB/oct
 90 - 400 Hz @ 0.30 g^2 /Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.012 g^2 /Hz

Composite = 14.0 g_{rms}

Directions B and C

20 - 360 Hz @ 0.020 g^2 /Hz
 360 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.025 g^2 /Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0023 g^2 /Hz

Composite = 5.6 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.013 g^2 /Hz
 20 - 76 Hz @ +9 dB/oct
 76 - 400 Hz @ 0.73 g^2 /Hz
 400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.030 g^2 /Hz

Composite = 21.9 g_{rms}

Directions B and C

20 - 290 Hz @ 0.027 g^2 /Hz
 290 - 400 Hz @ +6 dB/oct
 400 - 900 Hz @ 0.050 g^2 /Hz
 900 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0063 g^2 /Hz

Composite = 7.3 g_{rms}

Subzone 3-4-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 3-5 ET LO₂ Aft Bulkhead.(General Specifications)

Same as Subzone 3-5-1-A below.

**Subzone 3-5-1 ET LO₂ Aft Bulkhead Gores.(Stations X_t 963 to X_t 854)
(General Specifications)**

Same as Subzone 3-5-1-A below.

**Subzone 3-5-1-A Input to Components Mounted on the ET LO₂ Aft
Bulkhead Gores (Stations X_t 963 to X_t 854). Weight
Of Components < 12 lb.**

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.014 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 180 Hz @ 0.38 g²/Hz
180 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0030 g²/Hz

Composite = 10.2 g_{rms}

Directions B and C

20 Hz @ 0.00045 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 160 Hz @ 0.070 g²/Hz
160 - 225 Hz @ -9 dB/oct
225 - 600 Hz @ 0.025 g²/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0023 g²/Hz

Composite = 5.3 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.016 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 240 Hz @ 0.40 g²/Hz
240 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.0029 g²/Hz

Composite = 11.7 g_{rms}

Directions B and C

20 Hz @ 0.0032 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 410 Hz @ 0.080 g²/Hz
410 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0034 g²/Hz

Composite = 7.3 g_{rms}

3-5-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.058 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 180 Hz @ 1.50 g^2/Hz
180 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 20.4 g_{rms}

Directions B and C

20 Hz @ 0.0018 g^2/Hz
20 - 100 Hz @ +9 dB/oct
100 - 160 Hz @ 0.28 g^2/Hz
160 - 225 Hz @ -9 dB/oct
225 - 600 Hz @ 0.10 g^2/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0091 g^2/Hz

Composite = 10.7 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

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Subzone 3-5-1-B Input to Components Mounted on the ET LO₂ Aft Bulkhead Gores (Stations X_t 963 to X_t 854). Weight Of Components ≥ 12 but < 36 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.014 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 180 Hz @ 0.19 g²/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0016 g²/Hz

Composite = 7.4 g_{rms}

Directions B and C

20 Hz @ 0.00045 g²/Hz
 20 - 85 Hz @ +9 dB/oct
 85 - 160 Hz @ 0.035 g²/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.013 g²/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0011 g²/Hz

Composite = 3.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.016 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 240 Hz @ 0.20 g²/Hz
 240 - 2000 Hz @ -7 dB/oct
 2000 Hz @ 0.0014 g²/Hz

Composite = 8.5 g_{rms}

Directions B and C

20 Hz @ 0.0032 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 410 Hz @ 0.040 g²/Hz
 410 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0017 g²/Hz

Composite = 5.2 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.058 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 180 Hz @ 0.75 g²/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0062 g²/Hz

Composite = 14.9 g_{rms}

Directions B and C

20 Hz @ 0.0018 g²/Hz
 20 - 85 Hz @ +9 dB/oct
 85 - 160 Hz @ 0.14 g²/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.050 g²/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0045 g²/Hz

Composite = 7.7 g_{rms}

3-5-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 3-5-1-C Input to Components Mounted on the ET LO₂ Aft Bulkhead Gores (Stations X_t 963 to X_t 854). Weight of Component \geq 36 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.014 g²/Hz
 20 - 54 Hz @ +6 dB/oct
 54 - 180 Hz @ 0.095 g²/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00078 g²/Hz

Composite = 5.4 g_{rms}

Directions B and C

20 Hz @ 0.00045 g²/Hz
 20 - 70 Hz @ +9 dB/oct
 70 - 160 Hz @ 0.018 g²/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.0062 g²/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00058 g²/Hz

Composite = 2.7 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.016 g²/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 240 Hz @ 0.10 g²/Hz
 240 - 2000 Hz @ -7 dB/oct
 2000 Hz @ 0.00072 g²/Hz

Composite = 6.1 g_{rms}

Directions B and C

20 Hz @ 0.0032 g²/Hz
 20 - 70 Hz @ +6 dB/oct
 70 - 410 Hz @ 0.039 g²/Hz
 410 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0015 g²/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.058 g²/Hz
 20 - 54 Hz @ +6 dB/oct
 54 - 180 Hz @ 0.38 g²/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0031 g²/Hz

Composite = 10.8 g_{rms}

Directions B and C

20 Hz @ 0.0018 g²/Hz
 20 - 70 Hz @ +9 dB/oct
 70 - 160 Hz @ 0.070 g²/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.025 g²/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0023 g²/Hz

Composite = 5.5 g_{rms}

3-5-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*

5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*

5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

*** Design Criteria Only**

Subzone 3-5-2 ET LO₂ Aft Bulkhead Cap at Station X_t854.(General Specifications)

Same as Subzone 3-5-2-A below.

Subzone 3-5-2-A Input to Components Mounted on the ET LO₂ Aft Bulkhead Cap at Station X_t854. Weight of Components < 50 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.010 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 180 Hz @ 0.25 g²/Hz
180 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0021 g²/Hz

Composite = 8.5 g_{rms}

Directions B and C

20 Hz @ 0.00032 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 160 Hz @ 0.050 g²/Hz
160 - 225 Hz @ -9 dB/oct
225 - 600 Hz @ 0.018 g²/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0016 g²/Hz

Composite = 4.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.011 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 240 Hz @ 0.28 g²/Hz
240 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.0020 g²/Hz

Composite = 9.8 g_{rms}

Directions B and C

20 Hz @ 0.0022 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 410 Hz @ 0.056 g²/Hz
410 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0024 g²/Hz

Composite = 6.1 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.041 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 180 Hz @ 1.0 g²/Hz
180 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0084 g²/Hz

Composite = 17.1 g_{rms}

Directions B and C

20 Hz @ 0.0013 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 160 Hz @ 0.20 g²/Hz
160 - 225 Hz @ -9 dB/oct
225 - 600 Hz @ 0.070 g²/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0064 g²/Hz

Composite = 9.0 g_{rms}

3-5-2-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

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Subzone 3-5-2-B Input to Components Mounted on the ET LO₂ Aft Bulkhead Cap at Station X_t 854. Weight of Components ≥ 50 but < 150 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.010 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 180 Hz @ 0.12 g²/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0010 g²/Hz

Composite = 6.2 g_{rms}

Directions B and C

20 Hz @ 0.00032 g²/Hz
 20 - 85 Hz @ +9 dB/oct
 85 - 160 Hz @ 0.025 g²/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.0088 g²/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00080 g²/Hz

Composite = 3.2 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.011 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 240 Hz @ 0.14 g²/Hz
 240 - 2000 Hz @ -7 dB/oct
 2000 Hz @ 0.00098 g²/Hz

Composite = 7.1 g_{rms}

Directions B and C

20 Hz @ 0.0022 g²/Hz
 20 - 84 Hz @ +6 dB/oct
 84 - 410 Hz @ 0.038 g²/Hz
 410 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0019 g²/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.041 g²/Hz
 20 - 72 Hz @ +6 dB/oct
 72 - 180 Hz @ 0.50 g²/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0042 g²/Hz

Composite = 12.5 g_{rms}

Directions B and C

20 Hz @ 0.0013 g²/Hz
 20 - 85 Hz @ +9 dB/oct
 85 - 160 Hz @ 0.10 g²/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.035 g²/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0032 g²/Hz

Composite = 6.4 g_{rms}

3-5-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 3-5-2-C Input to Components Mounted on the ET LO₂ Aft Bulkhead Cap (Station X_t 854). Weight of Component \geq 150 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.010 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 180 Hz @ 0.062 g^2/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00052 g^2/Hz

Composite = 4.5 g_{rms}

Directions B and C

20 Hz @ 0.00032 g^2/Hz
 20 - 74 Hz @ +9 dB/oct
 74 - 160 Hz @ 0.015 g^2/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.0052 g^2/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00042 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.011 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 240 Hz @ 0.070 g^2/Hz
 240 - 2000 Hz @ -7 dB/oct
 2000 Hz @ 0.00050 g^2/Hz

Composite = 5.1 g_{rms}

Directions B and C

20 Hz @ 0.0022 g^2/Hz
 20 - 84 Hz @ +6 dB/oct
 84 - 410 Hz @ 0.038 g^2/Hz
 410 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0019 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.041 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 180 Hz @ 0.25 g^2/Hz
 180 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0021 g^2/Hz

Composite = 9.0 g_{rms}

Directions B and C

20 Hz @ 0.0013 g^2/Hz
 20 - 74 Hz @ +9 dB/oct
 74 - 160 Hz @ 0.060 g^2/Hz
 160 - 225 Hz @ -9 dB/oct
 225 - 600 Hz @ 0.021 g^2/Hz
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0017 g^2/Hz

Composite = 5.0 g_{rms}

3-5-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Zone 4 ET LO₂ Cylinder

Subzone 4-1 ET LO₂ Cylinder (Stations X_t 852 to X_t 747). (General Specifications)

Same as Subzone 4-1-A below.

Subzone 4-1-A Input to Components Mounted on the ET LO₂ Cylinder
(Stations X_t 852 to X_t 747). Weight of Component
< 15 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 120 Hz @ 0.020 g²/Hz
120 - 320 Hz @ -3 dB/oct
320 - 1000 Hz @ 0.075 g²/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.019 g²/Hz

Composite = 9.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00045 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 150 Hz @ 0.055 g²/Hz
150 - 170 Hz @ -9 dB/oct
170 - 1000 Hz @ 0.037 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.018 g²/Hz

Composite = 7.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 1000 Hz @ 0.12 g²/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.030 g²/Hz

Composite = 13.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0016 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 550 Hz @ 0.040 g²/Hz
550 - 700 Hz @ +9 dB/oct
700 - 1000 Hz @ 0.080 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.040 g²/Hz

Composite = 10.4 g_{rms}

4-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ $0.80 \text{ g}^2/\text{Hz}$
120 - 320 Hz @ -3 dB/oct
320 - 1000 Hz @ $0.30 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.075 \text{ g}^2/\text{Hz}$

Composite = $18.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0018 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +9 dB/oct
100 - 150 Hz @ $0.22 \text{ g}^2/\text{Hz}$
150 - 170 Hz @ -9 dB/oct
170 - 1000 Hz @ $0.15 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.075 \text{ g}^2/\text{Hz}$

Composite = $15.8 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2' shocks/axis)

See Table I

* Design Criteria Only

Subzone 4-1-B Input to Components Mounted on the ET LO₂ Cylinder
 (Stations X_t 852 to X_t 747). Weight of Component
 ≥ 15 but < 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 120 Hz @ 0.10 g²/Hz
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ 0.038 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0095 g²/Hz

Composite = 6.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00045 g²/Hz
 20 - 80 Hz @ +9 dB/oct
 80 - 150 Hz @ 0.037 g²/Hz
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ 0.018 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0095 g²/Hz

Composite = 5.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 1000 Hz @ 0.060 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.015 g²/Hz

Composite = 9.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0016 g²/Hz
 20 - 70 Hz @ +6 dB/oct
 70 - 550 Hz @ 0.020 g²/Hz
 550 - 700 Hz @ +9 dB/oct
 700 - 1000 Hz @ 0.040 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.020 g²/Hz

Composite = 7.4 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ 0.40 g²/Hz
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ 0.15 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.038 g²/Hz

Composite = 13.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0018 g²/Hz
 20 - 80 Hz @ +9 dB/oct
 80 - 150 Hz @ 0.11 g²/Hz
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ 0.075 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.038 g²/Hz

Composite = 11.2 g_{rms}

4-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 4-1-C Input to Components Mounted on the ET LO₂ Cylinder
(Stations X_t 852 to X_t 747). Weight of Component
≥ 45 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 120 Hz @ 0.050 g²/Hz
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ 0.019 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0048 g²/Hz

Composite = 4.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00045 g²/Hz
 20 - 62 Hz @ +9 dB/oct
 62 - 150 Hz @ 0.013 g²/Hz
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ 0.0095 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0047 g²/Hz

Composite = 4.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 1000 Hz @ 0.030 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0075 g²/Hz

Composite = 6.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0016 g²/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 550 Hz @ 0.010 g²/Hz
 550 - 700 Hz @ +9 dB/oct
 700 - 1000 Hz @ 0.020 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.010 g²/Hz

Composite = 5.2 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ 0.20 g²/Hz
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ 0.075 g²/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.019 g²/Hz

Composite = 9.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0018 g²/Hz
 20 - 62 Hz @ +9 dB/oct
 62 - 150 Hz @ 0.055 g²/Hz
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ 0.038 g²/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.019 g²/Hz

Composite = 8.0 g_{rms}

4-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Zone 5 ET Ogive and Nose Cap

Subzone 5-1 ET Ogive, Aft Section (Stations X_t 747 to X_t 537).
(General Specifications)

Same as Subzone 5-1-A below.

Subzone 5-1-A Input Components Mounted on the ET Ogive, Aft
Section (Stations X_t 747 to X_t 537). Weight of
Components <10 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 120 Hz @ $0.26 \text{ g}^2/\text{Hz}$
120 - 320 Hz @ -3 dB/oct
320 - 1000 Hz @ $0.085 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.021 \text{ g}^2/\text{Hz}$

Composite = $12.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.00050 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +9 dB/oct
100 - 150 Hz @ $0.060 \text{ g}^2/\text{Hz}$
150 - 170 Hz @ -9 dB/oct
170 - 1000 Hz @ $0.040 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.020 \text{ g}^2/\text{Hz}$

Composite = $8.2 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 1000 Hz @ $0.12 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.030 \text{ g}^2/\text{Hz}$

Composite = $13.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0018 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +6 dB/oct
100 - 550 Hz @ $0.046 \text{ g}^2/\text{Hz}$
550 - 700 Hz @ +9 dB/oct
700 - 1000 Hz @ $0.092 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.046 \text{ g}^2/\text{Hz}$

Composite = $11.1 \text{ g}_{\text{rms}}$

5-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ $0.92 \text{ g}^2/\text{Hz}$
120 - 320 Hz @ -3 dB/oct
320 - 1000 Hz @ $0.34 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.085 \text{ g}^2/\text{Hz}$

Composite = $24.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0020 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +9 dB/oct
100 - 150 Hz @ $0.24 \text{ g}^2/\text{Hz}$
150 - 170 Hz @ -9 dB/oct
170 - 1000 Hz @ $0.16 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.080 \text{ g}^2/\text{Hz}$

Composite = $16.5 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

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Subzone 5-1-B Input to Components Mounted on the ET Ogive, Aft Section (Stations X_t 747 to X_t 537). Weight of Component ≥ 10 but < 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 120 Hz @ $0.11 \text{ g}^2/\text{Hz}$
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ $0.042 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$

Composite = $8.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.00050 \text{ g}^2/\text{Hz}$
 20 - 80 Hz @ +9 dB/oct
 80 - 150 Hz @ $0.030 \text{ g}^2/\text{Hz}$
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ $0.020 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$

Composite = $5.8 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 1000 Hz @ $0.060 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.015 \text{ g}^2/\text{Hz}$

Composite = $9.4 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0018 \text{ g}^2/\text{Hz}$
 20 - 70 Hz @ +6 dB/oct
 70 - 550 Hz @ $0.023 \text{ g}^2/\text{Hz}$
 550 - 700 Hz @ +9 dB/oct
 700 - 1000 Hz @ $0.046 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.023 \text{ g}^2/\text{Hz}$

Composite = $7.9 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ $0.46 \text{ g}^2/\text{Hz}$
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ $0.17 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.042 \text{ g}^2/\text{Hz}$

Composite = $17.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0020 \text{ g}^2/\text{Hz}$
 20 - 80 Hz @ +9 dB/oct
 80 - 150 Hz @ $0.12 \text{ g}^2/\text{Hz}$
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ $0.082 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.041 \text{ g}^2/\text{Hz}$

Composite = $11.7 \text{ g}_{\text{rms}}$

5-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Subzone 5-1-C **Input to Components Mounted on the ET Ogive, Aft Section (Stations X_t 747 to X_t 537). Weight of Component ≥ 30 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 120 Hz @ 0.056 g^2 /Hz
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ 0.021 g^2 /Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0050 g^2 /Hz

Composite = 5.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00050 g^2 /Hz
 20 - 62 Hz @ +9 dB/oct
 62 - 150 Hz @ 0.015 g^2 /Hz
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ 0.010 g^2 /Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0050 g^2 /Hz

Composite = 4.2 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 1000 Hz @ 0.030 g^2 /Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0075 g^2 /Hz

Composite = 6.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0018 g^2 /Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 550 Hz @ 0.011 g^2 /Hz
 550 - 700 Hz @ +9 dB/oct
 700 - 1000 Hz @ 0.023 g^2 /Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.011 g^2 /Hz

Composite = 5.5 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ 0.23 g^2 /Hz
 120 - 320 Hz @ -3 dB/oct
 320 - 1000 Hz @ 0.085 g^2 /Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.021 g^2 /Hz

Composite = 11.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0020 g^2 /Hz
 20 - 62 Hz @ +9 dB/oct
 62 - 150 Hz @ 0.060 g^2 /Hz
 150 - 170 Hz @ -9 dB/oct
 170 - 1000 Hz @ 0.041 g^2 /Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.020 g^2 /Hz

Composite = 8.4 g_{rms}

5-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

**Subzone 5-2 ET Ogive, Forward Section (Stations X_t 537 to X_t 371).
(General Specifications)**

Same as Subzone 5-2-A below.

**Subzone 5-2-A Input to Components Mounted on the ET Ogive,
Forward Section (Stations X_t 537 to X_t 371). Weight
Of Component < 7 lb.**

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0085 g^2 /Hz
20 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ 1.75 g^2 /Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 37.9 g_{rms}

Directions B and C

20 Hz @ 0.00053 g^2 /Hz
20 - 100 Hz @ +9 dB/oct
100 - 1000 Hz @ 0.063 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.031 g^2 /Hz

Composite = 10.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.026 g^2 /Hz
20 - 80 Hz @ +6 dB/oct
80 - 150 Hz @ 0.40 g^2 /Hz
150 - 300 Hz @ +6 dB/oct
300 - 500 Hz @ 1.60 g^2 /Hz
500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.41 g^2 /Hz

Composite = 40.1 g_{rms}

Directions B and C

20 Hz @ 0.00030 g^2 /Hz
20 - 100 Hz @ +9 dB/oct
100 - 500 Hz @ 0.040 g^2 /Hz
500 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ 0.080 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.040 g^2 /Hz

Composite = 10.4 g_{rms}

5-2-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.034 \text{ g}^2/\text{Hz}$
20 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ $7.00 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.62 \text{ g}^2/\text{Hz}$

Composite = $75.9 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0021 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +9 dB/oct
100 - 1000 Hz @ $0.25 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.12 \text{ g}^2/\text{Hz}$

Composite = $20.1 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable.

Direction A - Perpendicular to Ogive

Direction B - Tangential to Ogive

Direction C - Tangential to Ogive, Perpendicular to Direction B

* Design Criteria Only

**Subzone 5-2-B Input to Components Mounted on the ET Ogive,
Forward Section (Stations X_t 537 to X_t 371). Weight
Of Component ≥ 7 but < 20 lb.**

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.0085 \text{ g}^2/\text{Hz}$
20 - 210 Hz @ +6 dB/oct
210 - 600 Hz @ $0.88 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.083 \text{ g}^2/\text{Hz}$

Composite = $27.6 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00053 \text{ g}^2/\text{Hz}$
20 - 80 Hz @ +9 dB/oct
80 - 1000 Hz @ $0.031 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.016 \text{ g}^2/\text{Hz}$

Composite = $7.1 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.026 \text{ g}^2/\text{Hz}$
20 - 56 Hz @ +6 dB/oct
56 - 150 Hz @ $0.20 \text{ g}^2/\text{Hz}$
150 - 300 Hz @ +6 dB/oct
300 - 500 Hz @ $0.80 \text{ g}^2/\text{Hz}$
500 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.20 \text{ g}^2/\text{Hz}$

Composite = $28.4 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00030 \text{ g}^2/\text{Hz}$
20 - 80 Hz @ +9 dB/oct
80 - 500 Hz @ $0.020 \text{ g}^2/\text{Hz}$
500 - 700 Hz @ +6 dB/oct
700 - 1000 Hz @ $0.040 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.020 \text{ g}^2/\text{Hz}$

Composite = $7.4 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.034 \text{ g}^2/\text{Hz}$
20 - 210 Hz @ +6 dB/oct
210 - 600 Hz @ $3.50 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.33 \text{ g}^2/\text{Hz}$

Composite = $55.2 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0021 \text{ g}^2/\text{Hz}$
20 - 78 Hz @ +9 dB/oct
78 - 1000 Hz @ $0.12 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.063 \text{ g}^2/\text{Hz}$

Composite = $14.3 \text{ g}_{\text{rms}}$

5-2-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A - Perpendicular to Ogive

Direction B - Tangential to Ogive

Direction C - Tangential to Ogive, Perpendicular to Direction B

* Design Criteria Only

Subzone 5-2-C Input to Components Mounted on the ET Ogive,
Forward Section (Stations X_t 537 to X_t 371). Weight
Of Component ≥ 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.0085 \text{ g}^2/\text{Hz}$
 20 - 150 Hz @ +6 dB/oct
 150 - 600 Hz @ $0.44 \text{ g}^2/\text{Hz}$
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.040 \text{ g}^2/\text{Hz}$

Composite = $20.0 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00050 \text{ g}^2/\text{Hz}$
 20 - 62 Hz @ +9 dB/oct
 62 - 1000 Hz @ $0.015 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.0075 \text{ g}^2/\text{Hz}$

Composite = $5.1 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.026 \text{ g}^2/\text{Hz}$
 20 - 40 Hz @ +6 dB/oct
 40 - 150 Hz @ $0.10 \text{ g}^2/\text{Hz}$
 150 - 300 Hz @ +6 dB/oct
 300 - 500 Hz @ $0.40 \text{ g}^2/\text{Hz}$
 500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.10 \text{ g}^2/\text{Hz}$

Composite = $20.1 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00030 \text{ g}^2/\text{Hz}$
 20 - 64 Hz @ +9 dB/oct
 64 - 500 Hz @ $0.010 \text{ g}^2/\text{Hz}$
 500 - 700 Hz @ +6 dB/oct
 700 - 1000 Hz @ $0.020 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$

Composite = $5.2 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.034 \text{ g}^2/\text{Hz}$
 20 - 150 Hz @ +6 dB/oct
 150 - 600 Hz @ $1.75 \text{ g}^2/\text{Hz}$
 600 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.16 \text{ g}^2/\text{Hz}$

Composite = $40.1 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0021 \text{ g}^2/\text{Hz}$
 20 - 62 Hz @ +9 dB/oct
 62 - 1000 Hz @ $0.063 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.032 \text{ g}^2/\text{Hz}$

Composite = $10.2 \text{ g}_{\text{rms}}$

5-2-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Ogive

Direction B--Tangential to Ogive

Direction C--Tangential to Ogive, Perpendicular to Direction B

*Design Criteria Only

Subzone 5-3 ET Nose Cap and Cover Plate (Stations X_t 371 to X_t 322). (General Specifications)

Same as Subzone 5-3-1-A below.

Subzone 5-3-1 ET Nose Cap (Stations X_t 371 to X_t 322). (General Specifications)

Same as Subzone 5-3-1-A below.

Subzone 5-3-1-A Input to Components Mounted on the ET Nose Cap
(Stations X_t 371 to X_t 322). Weight of Component
< 7 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.0035 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +6 dB/oct
120 - 370 Hz @ $0.12 \text{ g}^2/\text{Hz}$
370 - 900 Hz @ +6 dB/oct
900 - 2000 Hz @ $0.75 \text{ g}^2/\text{Hz}$

Composite = $32.7 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00050 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +9 dB/oct
100 - 2000 Hz @ $0.063 \text{ g}^2/\text{Hz}$

Composite = $10.9 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.0075 \text{ g}^2/\text{Hz}$
20 - 140 Hz @ +6 dB/oct
140 - 520 Hz @ $0.35 \text{ g}^2/\text{Hz}$
520 - 900 Hz @ +6 dB/oct
900 - 2000 Hz @ $1.00 \text{ g}^2/\text{Hz}$

Composite = $38.6 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00033 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +9 dB/oct
100 - 500 Hz @ $0.040 \text{ g}^2/\text{Hz}$
500 - 800 Hz @ +6 dB/oct
800 - 2000 Hz @ $0.080 \text{ g}^2/\text{Hz}$

Composite = $11.5 \text{ g}_{\text{rms}}$

5-3-1-A (Cont.)

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.014 g^2 /Hz
20 - 120 Hz @ +6 dB/oct
120 - 370 Hz @ 0.50 g^2 /Hz
370 - 900 Hz @ +6 dB/oct
900 - 2000 Hz @ 3.00 g^2 /Hz

Composite = 65.4 g_{rms}

Directions B and C

20 Hz @ 0.0020 g^2 /Hz
20 - 100 Hz @ +9 dB/oct
100 - 2000 Hz @ 0.25 g^2 /Hz

Composite = 21.9 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Nose Cap

Direction B--Tangential to Nose Cap

Direction C--Tangential to Nose Cap, Perpendicular to Direction B

* Design Criteria Only

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Subzone 5-3-1-B Input to Components Mounted on the ET Nose Cap
(Stations X_t 371 to X_t 322). Weight of Component
 ≥ 7 but < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ $0.0035 \text{ g}^2/\text{Hz}$
 20 - 85 Hz @ +6 dB/oct
 85 - 370 Hz @ $0.063 \text{ g}^2/\text{Hz}$
 370 - 900 Hz @ +6 dB/oct
 900 - 2000 Hz @ $0.38 \text{ g}^2/\text{Hz}$

Composite = $23.1 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00050 \text{ g}^2/\text{Hz}$
 20 - 80 Hz @ +9 dB/oct
 80 - 2000 Hz @ $0.033 \text{ g}^2/\text{Hz}$

Composite = $7.9 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ $0.0075 \text{ g}^2/\text{Hz}$
 20 - 100 Hz @ +6 dB/oct
 100 - 520 Hz @ $0.18 \text{ g}^2/\text{Hz}$
 520 - 900 Hz @ +6 dB/oct
 900 - 2000 Hz @ $0.50 \text{ g}^2/\text{Hz}$

Composite = $27.4 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.00033 \text{ g}^2/\text{Hz}$
 20 - 80 Hz @ +9 dB/oct
 80 - 500 Hz @ $0.020 \text{ g}^2/\text{Hz}$
 500 - 800 Hz @ +6 dB/oct
 800 - 2000 Hz @ $0.040 \text{ g}^2/\text{Hz}$

Composite = $8.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ $0.014 \text{ g}^2/\text{Hz}$
 20 - 85 Hz @ +6 dB/oct
 85 - 370 Hz @ $0.25 \text{ g}^2/\text{Hz}$
 370 - 900 Hz @ +6 dB/oct
 900 - 2000 Hz @ $1.50 \text{ g}^2/\text{Hz}$

Composite = $46.2 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0020 \text{ g}^2/\text{Hz}$
 20 - 80 Hz @ +9 dB/oct
 80 - 2000 Hz @ $0.13 \text{ g}^2/\text{Hz}$

Composite = $15.9 \text{ g}_{\text{rms}}$

5-3-1-B (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Nose Cap

Direction B--Tangential to Nose Cap

Direction C--Tangential to Nose Cap, Perpendicular to Direction B

* Design Criteria Only

Subzone 5-3-1-C Input to Components Mounted on the ET Nose Cap
(Stations X_t 371 to X_t 322). Weight of Component
≥ 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0035 g²/Hz
 20 - 61 Hz @ +6 dB/oct
 61 - 370 Hz @ 0.033 g²/Hz
 370 - 900 Hz @ +6 dB/oct
 900 - 2000 Hz @ 0.19 g²/Hz

Composite = 16.4 g_{rms}

Directions B and C

20 Hz @ 0.00050 g²/Hz
 20 - 63 Hz @ +9 dB/oct
 63 - 2000 Hz @ 0.016 g²/Hz

Composite = 5.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.0075 g²/Hz
 20 - 70 Hz @ +6 dB/oct
 70 - 520 Hz @ 0.090 g²/Hz
 520 - 900 Hz @ +6 dB/oct
 900 - 2000 Hz @ 0.25 g²/Hz

Composite = 19.4 g_{rms}

Directions B and C

20 Hz @ 0.00033 g²/Hz
 20 - 63 Hz @ +9 dB/oct
 63 - 500 Hz @ 0.010 g²/Hz
 500 - 800 Hz @ +6 dB/oct
 800 - 2000 Hz @ 0.020 g²/Hz

Composite = 5.7 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.014 g²/Hz
 20 - 61 Hz @ +6 dB/oct
 61 - 370 Hz @ 0.13 g²/Hz
 370 - 900 Hz @ +6 dB/oct
 900 - 2000 Hz @ 0.75 g²/Hz

Composite = 32.8 g_{rms}

Directions B and C

20 Hz @ 0.0020 g²/Hz
 20 - 63 Hz @ +9 dB/oct
 63 - 2000 Hz @ 0.063 g²/Hz

Composite = 11.1 g_{rms}

5-3-1-C (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

Direction A--Perpendicular to Nose Cap

Direction B--Tangential to Nose Cap

Direction C--Tangential to Nose Cap, Perpendicular to Direction B

* Design Criteria Only

Subzone 5-3-2 Input to Components Mounted on the ET LO Ogive
Coverplate or Coverplate Support Ring. (Station
X_t 371)

1. Acceptance Test Criteria (1 min/axis)

Longitudinal Axis

20 Hz @ 0.0035 g²/Hz
20 - 42 Hz @ + 6 dB/oct
42 - 370 Hz @ 0.015 g²/Hz
370 - 900 Hz @ + 6 dB/oct
900 - 2000 Hz @ 0.088 g²/Hz

Composite = 11.2 g_{rms}

Lateral Axes

20 Hz @ 0.00050 g²/Hz
20 - 49 Hz @ + 9 dB/oct
49 - 2000 Hz @ 0.0075 g²/Hz

Composite = 3.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Longitudinal Axis

20 Hz @ 0.0075 g²/Hz
20 - 47 Hz @ + 6 dB/oct
47 - 540 Hz @ 0.040 g²/Hz
540 - 900 Hz @ + 6 dB/oct
900 - 2000 Hz @ 0.11 g²/Hz

Composite = 12.9 g_{rms}

Lateral Axes

20 Hz @ 0.00033 g²/Hz
20 - 69 Hz @ + 9 dB/oct
69 - 2000 Hz @ 0.013 g²/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Longitudinal Axis

20 Hz @ 0.014 g²/Hz
20 - 42 Hz @ + 6 dB/oct
42 - 370 Hz @ 0.060 g²/Hz
370 - 900 Hz @ + 6 dB/oct
900 - 2000 Hz @ 0.35 g²/Hz

Composite = 22.4 g_{rms}

Lateral Axes

20 Hz @ 0.0020 g²/Hz
20 - 49 Hz @ + 9 dB/oct
49 - 2000 Hz @ 0.030 g²/Hz

Composite = 7.7 g_{rms}

5-3-2 (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Not Applicable

* Design Criteria Only

Zone 6 SRB Nozzle and Aft Skirt

Subzone 6-1 SRB Nozzle-- Stations 1990-1830 (General Specifications)

Same as Subzone 6-1-A below.

Subzone 6-1-A Input to Components Mounted on the SRB Nozzle

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.0095 g^2/Hz
20 - 800 Hz @ +3 dB/oct
800 - 1200 Hz @ 0.38 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.14 g^2/Hz

Composite = 21.8 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 Hz @ 0.038 g^2/Hz
20 - 800 Hz @ +3 dB/oct
800 - 1200 Hz @ 1.50 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.55 g^2/Hz

Composite = 43.6 g_{rms}

6-1-A (Cont.)

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 50 Hz @ $0.27 \text{ g}^2/\text{Hz}$
50 - 120 Hz @ +12 dB/oct
120 - 200 Hz @ $9.12 \text{ g}^2/\text{Hz}$
200 - 650 Hz @ -15 dB/oct
650 - 1400 Hz @ $0.031 \text{ g}^2/\text{Hz}$
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.014 \text{ g}^2/\text{Hz}$

Composite = $38.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 90 Hz @ $0.40 \text{ g}^2/\text{Hz}$
90 - 130 Hz @ +6 dB/oct
130 - 180 Hz @ $0.80 \text{ g}^2/\text{Hz}$
180 - 280 Hz @ -9 dB/oct
280 - 540 Hz @ $0.20 \text{ g}^2/\text{Hz}$
540 - 800 Hz @ +12 dB/oct
800 - 1400 Hz @ $1.00 \text{ g}^2/\text{Hz}$
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.33 \text{ g}^2/\text{Hz}$

Composite = $36.0 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Tables II, IX and X.

* Design Criteria Only

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Subzone 6-2 SRB AFT Skirt--Stations 1930-1837 (General Specifications)

Same as Subzone 6-2-A below.

**Subzone 6-2-A Input to Components Mounted on the SRB Aft Skirt.
Weight of Component <25 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 110 Hz @ +6 dB/oct.
110 - 200 Hz @ 0.38 g^2/Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0080 g^2/Hz

Composite = 10.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.011 g^2/Hz
20 - 30 Hz @ +6 dB/oct
30 - 53 Hz @ 0.025 g^2/Hz
53 - 150 Hz @ +6 dB/oct
150 - 800 Hz @ 0.20 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.032 g^2/Hz

Composite = 15.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 200 Hz @ 0.25 g^2/Hz
200 - 280 Hz @ -12 dB/oct
280 - 1200 Hz @ 0.060 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.036 g^2/Hz

Composite = 11.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 250 Hz @ +3 dB/oct
250 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 17.7 g_{rms}

6-2-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.13 g^2/Hz
 20 - 60 Hz @ +3 dB/oct
 60 - 200 Hz @ 0.40 g^2/Hz
 200 - 360 Hz @ -12 dB/oct
 360 - 1000 Hz @ 0.040 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.080 g^2/Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 800 Hz @ 0.18 g^2/Hz
 800 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.072 g^2/Hz

Composite = 16.5 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
 20 - 110 Hz @ +6 dB/oct
 110 - 200 Hz @ 1.0 g^2/Hz
 200 - 395 Hz @ -9 dB/oct
 395 - 800 Hz @ 0.20 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.032 g^2/Hz

Composite = 21.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.044 g^2/Hz
 20 - 30 Hz @ +6 dB/oct
 30 - 53 Hz @ 0.10 g^2/Hz
 53 - 150 Hz @ +6 dB/oct
 150 - 800 Hz @ 0.80 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.13 g^2/Hz

Composite = 30.8 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
 5 - 10 Hz @ 0.7 G's peak
 10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
 5 - 10 Hz @ 0.5 G's peak
 10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables III, IX and X.

* Design Criteria Only

Subzone 6-2-B Input to Components Mounted on the SRB Aft Skirt.
Weight of Component ≥ 25 but < 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 80 Hz @ +6 dB/oct
80 - 200 Hz @ 0.21 g^2/Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.028 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 8.4 g_{rms}

Long. and Tang. Axes

20 - 39 Hz @ 0.014 g^2/Hz
39 - 110 Hz @ +6 dB/oct
110 - 800 Hz @ 0.11 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 11.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 75 Hz @ +6 dB/oct
75 - 200 Hz @ 0.14 g^2/Hz
200 - 280 Hz @ -12 dB/oct
280 - 1200 Hz @ 0.033 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.020 g^2/Hz

Composite = 8.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 140 Hz @ +3 dB/oct
140 - 1000 Hz @ 0.11 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.055 g^2/Hz

Composite = 13.4 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.13 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 200 Hz @ 0.22 g^2/Hz
200 - 360 Hz @ -12 dB/oct
360 - 1000 Hz @ 0.022 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.011 g^2/Hz

Composite = 8.9 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.10 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.040 g^2/Hz

Composite = 12.3 g_{rms}

6-2-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 80 Hz @ +6 dB/oct
80 - 200 Hz @ 0.83 g^2/Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.11 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 16.8 g_{rms}

Long. and Tang. Axes

20 - 39 Hz @ 0.055 g^2/Hz
39 - 110 Hz @ +6 dB/oct
110 - 800 Hz @ 0.44 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.072 g^2/Hz

Composite = 23.1 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables III, IX and X.

* Design Criteria Only

Subzone 6-2-C Input to Components Mounted on the SRB Aft Skirt.
Weight of Component ≥ 75 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.013 \text{ g}^2/\text{Hz}$
20 - 60 Hz @ +6 dB/oct
60 - 200 Hz @ $0.11 \text{ g}^2/\text{Hz}$
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ $0.015 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.0024 \text{ g}^2/\text{Hz}$

Composite = $6.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 29 Hz @ $0.0075 \text{ g}^2/\text{Hz}$
29 - 82 Hz @ +6 dB/oct
82 - 800 Hz @ $0.060 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.0098 \text{ g}^2/\text{Hz}$

Composite = $8.6 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.010 \text{ g}^2/\text{Hz}$
20 - 55 Hz @ +6 dB/oct
55 - 200 Hz @ $0.077 \text{ g}^2/\text{Hz}$
200 - 280 Hz @ -12 dB/oct
280 - 1200 Hz @ $0.018 \text{ g}^2/\text{Hz}$
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$

Composite = $6.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.016 \text{ g}^2/\text{Hz}$
20 - 75 Hz @ +3 dB/oct
75 - 1000 Hz @ $0.060 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.030 \text{ g}^2/\text{Hz}$

Composite = $10.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 200 Hz @ $0.12 \text{ g}^2/\text{Hz}$
200 - 360 Hz @ -12 dB/oct
360 - 1000 Hz @ $0.012 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.0060 \text{ g}^2/\text{Hz}$

Composite = $6.7 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 800 Hz @ $0.054 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ $0.022 \text{ g}^2/\text{Hz}$

Composite = $9.0 \text{ g}_{\text{rms}}$

6-2-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 200 Hz @ 0.45 g^2/Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.060 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0095 g^2/Hz

Composite = 12.6 g_{rms}

Long. and Tang. Axes

20 - 29 Hz @ 0.030 g^2/Hz
29 - 82 Hz @ +6 dB/oct
82 - 800 Hz @ 0.24 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.039 g^2/Hz

Composite = 17.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables III, IX and X.

* Design Criteria Only

Zone 7 SRB Fuel Cylinder and Bulkheads.

Subzone 7-1 SRB Aft Fuel Bulkhead--Stations 1875-1818.(General Specifications)

Same as Subzone 7-1-A below.

Subzone 7-1-A Input to Components Mounted on the SRB Aft Fuel Bulkhead.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 - 73 Hz @ 0.00017 g^2/Hz
73 - 170 Hz @ +15 dB/oct
170 - 2000 Hz @ 0.012 g^2/Hz

Composite = 4.8 g_{rms}

Directions B and C

20 - 50 Hz @ 0.0050 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.015 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 3.4 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 - 50 Hz @ 0.020 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.060 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Direction A

20 - 73 Hz @ 0.00070 g^2/Hz
73 - 170 Hz @ +15 dB/oct
170 - 2000 Hz @ 0.050 g^2/Hz

Composite = 9.6 g_{rms}

Directions B and C

20 - 240 Hz @ 0.00094 g^2/Hz
240 - 700 Hz @ +9 dB/oct
700 - 1200 Hz @ 0.024 g^2/Hz
1200 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

7-1-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axis

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 3.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Tables IV, IX, and X

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

*Design Criteria Only

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Subzone 7-2 SRB Aft Fuel Cylinder--Stations 1837-1180.

Subzone 7-2-1 SRB Aft Fuel Cylinder--Stations 1837-1180.(General Specifications)

Same as Subzone 7-2-1-A below.

Subzone 7-2-1-A Input to Components Mounted on the SRB Aft Fuel Cylinder.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0090 g^2/Hz
20 - 180 Hz @ +6 dB/oct
180 - 280 Hz @ 0.78 g^2/Hz
280 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 17.6 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.0050 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.015 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 3.4 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 - 50 Hz @ 0.020 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.060 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 180 Hz @ +6 dB/oct
180 - 280 Hz @ 3.13 g^2/Hz
280 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.059 g^2/Hz

Composite = 35.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0039 g^2/Hz
20 - 80 Hz @ +6 dB/oct
80 - 275 Hz @ 0.063 g^2/Hz
275 - 560 Hz @ -9 dB/oct
560 - 2000 Hz @ 0.0075 g^2/Hz

Composite = 5.6 g_{rms}

7-2-1-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*

5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*

5 - 10 Hz @ 0.6 G's peak

10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Tables IV, IX and X.

***Design Criteria Only**

Subzone 7-2-2 SRB/ET Attach Ring @ Station 1511. (General Specifications)

Same as Subzone 7-2-2-A below.

Subzone 7-2-2-A Input to Components on the SRB/ET Attach Ring.

1. Acceptance Test Criteria (1 min/axis)

Radial and Tangential Axes

20 Hz @ 0.0025 g^2/Hz
20 - 120 Hz @ +6 dB/oct
120 - 200 Hz @ 0.095 g^2/Hz
200 - 375 Hz @ -9 dB/oct
375 - 2000 Hz @ 0.015 g^2/Hz

Composite = 6.4 g_{rms}

Longitudinal Axis

20 - 105 Hz @ 0.030 g^2/Hz
105 - 180 Hz @ +9 dB/oct
180 - 1000 Hz @ 0.16 g^2/Hz
1000 - 1125 Hz @ +12 dB/oct
1125 - 1400 Hz @ 0.25 g^2/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.085 g^2/Hz

Composite = 17.9 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial and Tangential Axes

20 - 50 Hz @ 0.020 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.060 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

Longitudinal Axis

20 - 85 Hz @ 0.014 g^2/Hz
85 - 220 Hz @ +6 dB/oct
220 - 900 Hz @ 0.090 g^2/Hz
900 - 1175 Hz @ +9 dB/oct
1175 - 1500 Hz @ 0.20 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.11 g^2/Hz

Composite = 15.7 g_{rms}

7-2-2-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial and Tangential Axes

20 - 50 Hz @ 0.020 g^2/Hz
 50 - 150 Hz @ +3 dB/oct
 150 - 500 Hz @ 0.060 g^2/Hz
 500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

Longitudinal Axis

20 - 75 Hz @ 0.0060 g^2/Hz
 75 - 220 Hz @ +6 dB/oct
 220 - 950 Hz @ 0.048 g^2/Hz
 950 - 1175 Hz @ +9 dB/oct
 1175 - 1500 Hz @ 0.090 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.050 g^2/Hz

Composite = 10.8 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial and Tangential Axes

20 Hz @ 0.010 g^2/Hz
 20 - 120 Hz @ +6 dB/oct
 120 - 200 Hz @ 0.38 g^2/Hz
 200 - 375 Hz @ -9 dB/oct
 375 - 2000 Hz @ 0.060 g^2/Hz

Composite = 12.9 g_{rms}

Longitudinal Axis

20 - 105 Hz @ 0.12 g^2/Hz
 105 - 180 Hz @ +9 dB/oct
 180 - 1000 Hz @ 0.63 g^2/Hz
 1000 - 1125 Hz @ +12 dB/oct
 1125 - 1400 Hz @ 1.00 g^2/Hz
 1400 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.34 g^2/Hz

Composite = 35.8 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables IV, IX and X.

* Design Criteria Only

Subzone 7-3 SRB Forward Fuel Cylinder--Stations 1180-524.
(General Specifications)

Same as Subzone 7-3-A below.

**Subzone 7-3-A Input to Components on the SRB Forward Fuel
Cylinder.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0014 g^2/Hz
20 - 150 Hz @ +6 dB/oct
150 - 280 Hz @ 0.080 g^2/Hz
280 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.00012 g^2/Hz

Composite = 4.8 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.0050 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.015 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 3.4 g_{rms}

**2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each
axis)**

20 - 50 Hz @ 0.020 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.060 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

**3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in
each axis)**

Radial Axis

20 Hz @ 0.0055 g^2/Hz
20 - 150 Hz @ +6 dB/oct
150 - 280 Hz @ 0.31 g^2/Hz
280 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.00050 g^2/Hz

Composite = 9.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0016 g^2/Hz
20 - 80 Hz @ +9 dB/oct
80 - 200 Hz @ 0.11 g^2/Hz
200 - 800 Hz @ -10 dB/oct
800 - 2000 Hz @ 0.0053 g^2/Hz

Composite = 5.3 g_{rms}

7-3-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Tables IV, IX and X.

* Design Criteria Only

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Subzone 7-4 SRB Forward Fuel Bulkhead--Stations 531-486.
(General Specifications)

Same as Subzone 7-4-A below.

Subzone 7-4-A Input to Components on the SRB Forward Fuel Bulkhead.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 - 55 Hz @ 0.00018 g^2/Hz
55 - 200 Hz @ +12 dB/oct
200 - 300 Hz @ 0.032 g^2/Hz
300 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 4.7 g_{rms}

Directions B and C

20 - 50 Hz @ 0.0050 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.015 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 3.4 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 - 50 Hz @ 0.020 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.060 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Direction A

20 - 55 Hz @ 0.00070 g^2/Hz
55 - 200 Hz @ +12 dB/oct
200 - 300 Hz @ 0.13 g^2/Hz
300 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.019 g^2/Hz

Composite = 9.5 g_{rms}

Directions B and C

20 Hz @ 0.0012 g^2/Hz
20 - 40 Hz @ +6 dB/oct
40 - 300 Hz @ 0.0047 g^2/Hz
300 - 450 Hz @ +12 dB/oct
450 - 1000 Hz @ 0.024 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0030 g^2/Hz

Composite = 5.0 g_{rms}

7-4-A (Cont.)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Tables IV, IX and X.

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Zone 8**SRB Forward Skirt****Subzone 8-1****SRB Forward Skirt -- Stations 524-485 (General Specifications)****1. Acceptance Test Criteria (1 min/axis)****Radial Axis**

20 Hz @ 0.0025 g^2/Hz
20 - 60 Hz @ +3 dB/oct
60 Hz @ 0.0075 g^2/Hz
60 - 250 Hz @ +6 dB/oct
250 - 600 Hz @ 0.13 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0033 g^2/Hz

Composite = 9.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 5.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)**Radial Axis**

20 Hz @ 0.0072 g^2/Hz
20 - 55 Hz @ +3 dB/oct
55 Hz @ 0.020 g^2/Hz
55 - 200 Hz @ +6 dB/oct
200 - 600 Hz @ 0.25 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0064 g^2/Hz

Composite = 13.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 73 Hz @ +3 dB/oct
73 Hz @ 0.044 g^2/Hz
73 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.083 g^2/Hz
150 - 190 Hz @ -9 dB/oct
190 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 7.9 g_{rms}

8-1 (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
 20 - 60 Hz @ +3 dB/oct
 60 Hz @ 0.030 g^2/Hz
 60 - 250 Hz @ +6 dB/oct
 250 - 600 Hz @ 0.50 g^2/Hz
 600 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.013 g^2/Hz

Composite = 18.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 1000 Hz @ 0.080 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 10.8 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.12 g^2/Hz
 20 - 120 Hz @ +3 dB/oct
 120 - 200 Hz @ 0.70 g^2/Hz
 200 - 235 Hz @ -6 dB/oct
 235 - 500 Hz @ 0.50 g^2/Hz
 500 - 1000 Hz @ -12 dB/oct
 1000 Hz @ 0.032 g^2/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0041 g^2/Hz

Composite = 18.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 150 Hz @ 0.30 g^2/Hz
 150 - 235 Hz @ -12 dB/oct
 235 - 800 Hz @ 0.050 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0080 g^2/Hz

Composite = 9.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
 5 - 10 Hz @ 0.7 G's peak
 10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
 5 - 10 Hz @ 0.5 G's peak
 10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

**Subzone 8-1-1 SRB Forward Skirt Skin and Stringers--Stations
524-485 (General Specifications)**

Same as Subzone 8-1-1-A below.

**Subzone 8-1-1-A Input to Components Mounted on the SRB Forward
Skirt Skin or Stringers--Stations 524-485. Weight
of Component <30 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.030 g^2/Hz
20 - 120 Hz @ +3 dB/oct
120 - 200 Hz @ 0.18 g^2/Hz
200 - 235 Hz @ -6 dB/oct
235 - 500 Hz @ 0.12 g^2/Hz
500 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00050 g^2/Hz

Composite = 9.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0078 g^2/Hz
20 - 90 Hz @ +3 dB/oct
90 - 150 Hz @ 0.035 g^2/Hz
150 - 575 Hz @ -12 dB/oct
575 - 1100 Hz @ 0.00062 g^2/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00019 g^2/Hz

Composite = 2.5 g_{rms}

**2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in
each axis)**

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 200 Hz @ +6 dB/oct
200 - 600 Hz @ 0.25 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0020 g^2/Hz

Composite = 12.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.083 g^2/Hz
150 - 310 Hz @ -9 dB/oct
310 - 1000 Hz @ 0.0090 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

8-1-1-A (Cont.)

3. Boost Random Vibration-Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
 20 - 250 Hz @ +6 dB/oct
 250 - 600 Hz @ 0.50 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0041 g^2/Hz

Composite = 17.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.066 g^2/Hz
 150 - 380 Hz @ -6 dB/oct
 380 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.12 g^2/Hz
 20 - 120 Hz @ +3 dB/oct
 120 - 200 Hz @ 0.70 g^2/Hz
 200 - 235 Hz @ -6 dB/oct
 235 - 500 Hz @ 0.50 g^2/Hz
 500 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0020 g^2/Hz

Composite = 18.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.031 g^2/Hz
 20 - 90 Hz @ +3 dB/oct
 90 - 150 Hz @ 0.14 g^2/Hz
 150 - 575 Hz @ -12 dB/oct
 575 - 1100 Hz @ 0.0025 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00076 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-1-1-B Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Stations 524-485. Weight of Component ≥ 30 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.030 g^2/Hz
 20 - 60 Hz @ +3 dB/oct.
 60 - 200 Hz @ 0.088 g^2/Hz
 200 - 235 Hz @ -6 dB/oct.
 235 - 500 Hz @ 0.062 g^2/Hz
 500 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00025 g^2/Hz

Composite = 6.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0078 g^2/Hz
 20 - 90 Hz @ +3 dB/oct
 90 - 150 Hz @ 0.035 g^2/Hz
 150 - 575 Hz @ -12 dB/oct
 575 - 1100 Hz @ 0.00062 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00019 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.12 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0010 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.083 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0090 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

8-1-1-B (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
 20 - 175 Hz @ +6 dB/oct
 175 - 600 Hz @ 0.25 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0021 g^2/Hz

Composite = 13.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.060 g^2/Hz
 150 - 380 Hz @ -6 dB/oct
 380 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.12 g^2/Hz
 20 - 60 Hz @ +3 dB/oct
 60 - 200 Hz @ 0.35 g^2/Hz
 200 - 235 Hz @ -6 dB/oct
 235 - 500 Hz @ 0.25 g^2/Hz
 500 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0010 g^2/Hz

Composite = 13.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.031 g^2/Hz
 20 - 90 Hz @ +3 dB/oct
 90 - 150 Hz @ 0.14 g^2/Hz
 150 - 575 Hz @ -12 dB/oct
 575 - 1100 Hz @ 0.0025 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00076 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-1-1-C Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Stations 524-485. Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.030 g^2/Hz
 20 - 38 Hz @ +3 dB/oct
 38 - 200 Hz @ 0.055 g^2/Hz
 200 - 235 Hz @ -6 dB/oct.
 235 - 500 Hz @ 0.040 g^2/Hz
 500 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00016 g^2/Hz

Composite = 5.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0078 g^2/Hz
 20 - 90 Hz @ +3 dB/oct
 90 - 150 Hz @ 0.035 g^2/Hz
 150 - 575 Hz @ -12 dB/oct
 575 - 1100 Hz @ 0.00062 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00019 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 115 Hz @ +6 dB/oct
 115 - 600 Hz @ 0.080 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00065 g^2/Hz

Composite = 7.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.083 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0090 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

8-1-1-C (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.16 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0013 g^2/Hz

Composite = 10.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.066 g^2/Hz
 150 - 380 Hz @ -6 dB/oct
 380 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.12 g^2/Hz
 20 - 38 Hz @ +3 dB/oct
 38 - 200 Hz @ 0.22 g^2/Hz
 200 - 235 Hz @ -6 dB/oct
 235 - 500 Hz @ 0.16 g^2/Hz
 500 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00063 g^2/Hz

Composite = 10.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.031 g^2/Hz
 20 - 90 Hz @ +3 dB/oct
 90 - 150 Hz @ 0.14 g^2/Hz
 150 - 575 Hz @ -12 dB/oct
 575 - 1100 Hz @ 0.0025 g^2/Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00076 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-1-2 SRB Forward Skirt Rings--Stations 524-485 (General Specifications)

Same as Subzone 8-1-2-A below.

Subzone 8-1-2-A Input to Components Mounted on the SRB Forward Skirt Rings--Stations 524-485. Weight of Component < 40 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 400 Hz @ +3 dB/oct.
400 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0032 g^2/Hz

Composite = 6.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 5.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 310 Hz @ 0.054 g^2/Hz
310 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.090 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.060 g^2/Hz
150 - 180 Hz @ -6 dB/oct
180 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 7.8 g_{rms}

8-1-2-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
 20 - 400 Hz @ +3 dB/oct
 400 - 800 Hz @ 0.20 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.013 g^2/Hz

Composite = 13.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 1000 Hz @ 0.080 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 10.8 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 200 Hz @ 0.25 g^2/Hz
 200 - 260 Hz @ -6 dB/oct
 260 - 600 Hz @ 0.15 g^2/Hz
 600 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0041 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 150 Hz @ 0.30 g^2/Hz
 150 - 235 Hz @ -12 dB/oct
 235 - 800 Hz @ 0.050 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0080 g^2/Hz

Composite = 9.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-1-2-B Input to Components Mounted on the SRB Forward Skirt Rings--Stations 524-485. Weight of Component ≥ 40 but < 80 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 200 Hz @ +3 dB/oct
 200 - 800 Hz @ 0.025 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0016 g^2/Hz

Composite = 5.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0025 g^2/Hz

Composite = 3.8 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
 20 - 75 Hz @ +3 dB/oct
 75 - 220 Hz @ 0.027 g^2/Hz
 220 - 280 Hz @ +6 dB/oct
 280 - 800 Hz @ 0.045 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0030 g^2/Hz

Composite = 6.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 150 Hz @ 0.030 g^2/Hz
 150 - 180 Hz @ -6 dB/oct
 180 - 1000 Hz @ 0.020 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0050 g^2/Hz

Composite = 5.5 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
 20 - 200 Hz @ +3 dB/oct
 200 - 800 Hz @ 0.10 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0065 g^2/Hz

Composite = 10.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 1000 Hz @ 0.040 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 7.7 g_{rms}

8-1-2-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 52 Hz @ +3 dB/oct
52 - 200 Hz @ 0.13 g^2/Hz
200 - 260 Hz @ -6 dB/oct
260 - 600 Hz @ 0.075 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0021 g^2/Hz

Composite = 8.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 150 Hz @ 0.15 g^2/Hz
150 - 235 Hz @ -12 dB/oct.
235 - 800 Hz @ 0.025 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0040 g^2/Hz

Composite = 7.1 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-1-2-C Input to Components Mounted on the SRB Forward Skirt Rings--Stations 524-485. Weight of Component ≥ 80 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 130 Hz @ +3 dB/oct
 130 - 800 Hz @ 0.016 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0010 g^2/Hz

Composite = 4.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
 20 - 33 Hz @ +3 dB/oct
 33 - 1000 Hz @ 0.0065 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0016 g^2/Hz

Composite = 3.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 180 Hz @ 0.018 g^2/Hz
 180 - 230 Hz @ +6 dB/oct
 230 - 800 Hz @ 0.030 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0020 g^2/Hz

Composite = 5.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
 20 - 34 Hz @ +3 dB/oct
 34 - 150 Hz @ 0.020 g^2/Hz
 150 - 180 Hz @ -6 dB/oct
 180 - 1000 Hz @ 0.013 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0033 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
 20 - 130 Hz @ +3 dB/oct
 130 - 800 Hz @ 0.065 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0042 g^2/Hz

Composite = 8.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
 20 - 33 Hz @ +3 dB/oct
 33 - 1000 Hz @ 0.026 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0065 g^2/Hz

Composite = 6.2 g_{rms}

8-1-2-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 200 Hz @ 0.075 g^2/Hz
200 - 245 Hz @ -6 dB/oct
245 - 600 Hz @ 0.050 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 6.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 150 Hz @ 0.10 g^2/Hz
150 - 235 Hz @ -12 dB/oct
235 - 800 Hz @ 0.017 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0028 g^2/Hz

Composite = 5.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

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Subzone 8-2

SRB Forward Skirt--Stations 484-434 (General Specifications)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.13 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 275 Hz @ 0.32 g^2/Hz
 275 - 380 Hz @ -9 dB/oct
 380 - 500 Hz @ 0.12 g^2/Hz
 500 - 950 Hz @ -12 dB/oct
 950 - 1500 Hz @ 0.010 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0058 g^2/Hz

Composite = 12.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 130 Hz @ 0.030 g^2/Hz
 130 - 390 Hz @ +3 dB/oct
 390 - 1200 Hz @ 0.090 g^2/Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.055 g^2/Hz

Composite = 12.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
 20 - 200 Hz @ +3 dB/oct
 200 - 555 Hz @ 0.36 g^2/Hz
 555 - 900 Hz @ -12 dB/oct
 900 - 1500 Hz @ 0.050 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.038 g^2/Hz

Composite = 16.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.056 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 340 Hz @ 0.14 g^2/Hz
 340 - 400 Hz @ +6 dB/oct
 400 - 1200 Hz @ 0.19 g^2/Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.11 g^2/Hz

Composite = 17.9 g_{rms}

8-2 (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.056 g^2/Hz
 20 - 250 Hz @ +3 dB/oct
 250 - 550 Hz @ 0.70 g^2/Hz
 550 - 900 Hz @ -12 dB/oct
 900 - 1500 Hz @ 0.10 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.075 g^2/Hz

Composite = 22.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.048 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 130 Hz @ 0.12 g^2/Hz
 130 - 390 Hz @ +3 dB/oct
 390 - 1200 Hz @ 0.36 g^2/Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.22 g^2/Hz

Composite = 24.2 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.51 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 275 Hz @ 1.30 g^2/Hz
 275 - 380 Hz @ -9 dB/oct
 380 - 500 Hz @ 0.50 g^2/Hz
 500 - 950 Hz @ -12 dB/oct
 950 - 1500 Hz @ 0.040 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.023 g^2/Hz

Composite = 24.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 150 Hz @ 0.30 g^2/Hz
 150 - 235 Hz @ -12 dB/oct
 235 - 800 Hz @ 0.050 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0080 g^2/Hz

Composite = 9.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

**Subzone 8-2-1 SRB Forward Skirt Skin and Stringers--Stations
484-434 (General Specifications)**

Same as Subzone 8-2-1-A below.

**Subzone 8-2-1-A Input to Components Mounted on the SRB Forward
Skirt Skin or Stringers--Stations 484-434... Weight
of Component < 30 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0082 g^2/Hz
20 - 250 Hz @ +6 dB/oct
250 - 600 Hz @ 0.12 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0010 g^2/Hz

Composite = 8.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0062 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 150 Hz @ 0.025 g^2/Hz
150 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00014 g^2/Hz

Composite = 2.5 g_{rms}

**2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in
each axis)**

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 200 Hz @ +6 dB/oct
200 - 600 Hz @ 0.25 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0020 g^2/Hz

Composite = 12.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.083 g^2/Hz
150 - 310 Hz @ -9 dB/oct
310 - 1000 Hz @ 0.0090 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

8-2-1-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.033 g^2/Hz
20 - 250 Hz @ +6 dB/oct
250 - 600 Hz @ 0.50 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0041 g^2/Hz

Composite = 17.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.066 g^2/Hz
150 - 380 Hz @ -6 dB/oct
380 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 500 Hz @ 0.50 g^2/Hz
500 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0020 g^2/Hz

Composite = 17.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.025 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 150 Hz @ 0.10 g^2/Hz
150 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00057 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-2-1-B Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Stations 484-434. Weight of Component ≥ 30 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.00082 g^2/Hz
 20 - 175 Hz @ +6 dB/oct
 175 - 600 Hz @ 0.062 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00052 g^2/Hz

Composite = 6.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0062 g^2/Hz
 20 - 80 Hz @ +3 dB/oct
 80 - 150 Hz @ 0.025 g^2/Hz
 150 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00014 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.12 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0010 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.083 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0090 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
 20 - 175 Hz @ +6 dB/oct
 175 - 600 Hz @ 0.25 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0021 g^2/Hz

Composite = 13.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.066 g^2/Hz
 150 - 380 Hz @ -6 dB/oct
 380 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

8-2-1-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 500 Hz @ 0.25 g^2/Hz
500 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0010 g^2/Hz

Composite = 12.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.025 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 150 Hz @ 0.10 g^2/Hz
150 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00057 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-2-1-C Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Stations 484-434. Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.00082 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.040 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00032 g^2/Hz

Composite = 5.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0062 g^2/Hz
 20 - 80 Hz @ +3 dB/oct
 80 - 150 Hz @ 0.025 g^2/Hz
 150 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00014 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 115 Hz @ +6 dB/oct
 115 - 600 Hz @ 0.080 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00065 g^2/Hz

Composite = 7.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.083 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0090 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.16 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0013 g^2/Hz

Composite = 10.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.066 g^2/Hz
 150 - 380 Hz @ -6 dB/oct
 380 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

8-2-1-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
20 - 32 Hz @ +3 dB/oct
32 - 500 Hz @ 0.16 g^2/Hz
500 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00063 g^2/Hz

Composite = 10.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.025 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 150 Hz @ 0.10 g^2/Hz
150 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00057 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-2-2 SRB Forward Skirt Rings--Stations 484-434 (General Specifications)

Same as Subzone 8-2-2-A below.

Subzone 8-2-2-A Input to Components Mounted on the SRB Forward Skirt Rings--Stations 484-434. Weight of Component < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.13 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 270 Hz @ 0.32 g^2/Hz
270 - 865 Hz @ -9 dB/oct
865 - 1500 Hz @ 0.010 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 11.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 130 Hz @ 0.030 g^2/Hz
130 - 390 Hz @ +3 dB/oct
390 - 1200 Hz @ 0.090 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.055 g^2/Hz

Composite = 12.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 200 Hz @ +3 dB/oct
200 - 400 Hz @ 0.36 g^2/Hz
400 - 775 Hz @ -9 dB/oct
775 - 1500 Hz @ 0.050 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 14.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.056 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 340 Hz @ 0.14 g^2/Hz
340 - 400 Hz @ +6 dB/oct
400 - 1200 Hz @ 0.19 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.11 g^2/Hz

Composite = 17.9 g_{rms}

8-2-2-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.056 g^2/Hz
 20 - 250 Hz @ +3 dB/oct
 250 - 400 Hz @ 0.70 g^2/Hz
 400 - 775 Hz @ -9 dB/oct
 775 - 1500 Hz @ 0.10 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.075 g^2/Hz

Composite = 20.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.048 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 130 Hz @ 0.12 g^2/Hz
 130 - 390 Hz @ +3 dB/oct
 390 - 1200 Hz @ 0.36 g^2/Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.22 g^2/Hz

Composite = 24.2 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.51 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 270 Hz @ 1.30 g^2/Hz
 270 - 865 Hz @ -9 dB/oct
 865 - 1500 Hz @ 0.040 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.023 g^2/Hz

Composite = 22.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.80 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 1.60 g^2/Hz
 60 - 90 Hz @ -12 dB/oct
 90 - 600 Hz @ 0.30 g^2/Hz
 600 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.090 g^2/Hz

Composite = 21.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-2-2-B Input to Components Mounted on the SRB Forward Skirt Rings--Stations 484-434. Weight of Component ≥ 20 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.13 \text{ g}^2/\text{Hz}$
 20 - 34 Hz @ +3 dB/oct.
 34 - 270 Hz @ $0.22 \text{ g}^2/\text{Hz}$
 270 - 820 Hz @ -9 dB/oct.
 820 - 1500 Hz @ $0.0078 \text{ g}^2/\text{Hz}$
 1500 - 2000 Hz @ -6 dB/oct.
 2000 Hz @ $0.0042 \text{ g}^2/\text{Hz}$

Composite = $9.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.012 \text{ g}^2/\text{Hz}$
 20 - 34 Hz @ +3 dB/oct
 34 - 85 Hz @ $0.020 \text{ g}^2/\text{Hz}$
 85 - 255 Hz @ +3 dB/oct
 255 - 1200 Hz @ $0.060 \text{ g}^2/\text{Hz}$
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.035 \text{ g}^2/\text{Hz}$

Composite = $10.0 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.036 \text{ g}^2/\text{Hz}$
 20 - 135 Hz @ +3 dB/oct
 135 - 400 Hz @ $0.24 \text{ g}^2/\text{Hz}$
 400 - 775 Hz @ -9 dB/oct
 775 - 1500 Hz @ $0.033 \text{ g}^2/\text{Hz}$
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.025 \text{ g}^2/\text{Hz}$

Composite = $12.4 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.056 \text{ g}^2/\text{Hz}$
 20 - 34 Hz @ +3 dB/oct
 34 - 280 Hz @ $0.093 \text{ g}^2/\text{Hz}$
 280 - 330 Hz @ +6 dB/oct
 330 - 1200 Hz @ $0.13 \text{ g}^2/\text{Hz}$
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.077 \text{ g}^2/\text{Hz}$

Composite = $14.9 \text{ g}_{\text{rms}}$

8-2-2-B (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.056 g^2/Hz
20 - 165 Hz @ +3 dB/oct
165 - 400 Hz @ 0.46 g^2/Hz
400 - 775 Hz @ -9 dB/oct
775 - 1500 Hz @ 0.063 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.047 g^2/Hz

Composite = 16.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.048 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 85 Hz @ 0.080 g^2/Hz
85 - 255 Hz @ +3 dB/oct
255 - 1200 Hz @ 0.24 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.14 g^2/Hz

Composite = 20.1 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.51 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 270 Hz @ 0.86 g^2/Hz
270 - 820 Hz @ -9 dB/oct
820 - 1500 Hz @ 0.031 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.017 g^2/Hz

Composite = 18.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.80 g^2/Hz
20 - 32 Hz @ +3 dB/oct
32 - 57 Hz @ 1.30 g^2/Hz
57 - 90 Hz @ -12 dB/oct
90 - 600 Hz @ 0.20 g^2/Hz
600 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.060 g^2/Hz

Composite = 17.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-2-2-C Input to Components Mounted on the SRB Forward Skirt Rings--Stations 484-434. Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.092 \text{ g}^2/\text{Hz}$
 20 - 30 Hz @ +3 dB/oct
 30 - 270 Hz @ $0.14 \text{ g}^2/\text{Hz}$
 270 - 805 Hz @ -9 dB/oct
 805 - 1500 Hz @ $0.0052 \text{ g}^2/\text{Hz}$
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.0030 \text{ g}^2/\text{Hz}$

Composite = $7.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 52 Hz @ $0.012 \text{ g}^2/\text{Hz}$
 52 - 160 Hz @ +3 dB/oct
 160 - 1200 Hz @ $0.038 \text{ g}^2/\text{Hz}$
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.022 \text{ g}^2/\text{Hz}$

Composite = $8.0 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.036 \text{ g}^2/\text{Hz}$
 20 - 85 Hz @ +3 dB/oct
 85 - 400 Hz @ $0.15 \text{ g}^2/\text{Hz}$
 400 - 775 Hz @ -9 dB/oct
 775 - 1500 Hz @ $0.022 \text{ g}^2/\text{Hz}$
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.016 \text{ g}^2/\text{Hz}$

Composite = $10.1 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 220 Hz @ $0.058 \text{ g}^2/\text{Hz}$
 220 - 270 Hz @ +6 dB/oct
 270 - 1200 Hz @ $0.088 \text{ g}^2/\text{Hz}$
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ $0.053 \text{ g}^2/\text{Hz}$

Composite = $12.3 \text{ g}_{\text{rms}}$

8-2-2-C (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.056 g^2/Hz
20 - 105 Hz @ +3 dB/oct
105 - 400 Hz @ 0.29 g^2/Hz
400 - 775 Hz @ -9 dB/oct
775 - 1500 Hz @ 0.040 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.030 g^2/Hz

Composite = 13.8 g_{rms}

Long. and Tang. Axes

20 - 52 Hz @ 0.048 g^2/Hz
52 - 160 Hz @ +3 dB/oct
160 - 1200 Hz @ 0.15 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.090 g^2/Hz

Composite = 16.1 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial-Axis

20 Hz @ 0.37 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 270 Hz @ 0.55 g^2/Hz
270 - 805 Hz @ -9 dB/oct
805 - 1500 Hz @ 0.021 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 15.0 g_{rms}

Long. and Tang. Axes

20 - 55 Hz @ 0.80 g^2/Hz
55 - 90 Hz @ -12 dB/oct
90 - 600 Hz @ 0.10 g^2/Hz
600 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.030 g^2/Hz

Composite = 12.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3

SRB Forward Skirt--Stations 433-395 (General Specifications)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.035 g^2/Hz
 20 - 73 Hz @ +3 dB/oct
 73 Hz @ 0.12 g^2/Hz
 73 - 250 Hz @ +6 dB/oct
 250 - 600 Hz @ 1.00 g^2/Hz
 600 - 620 Hz @ -12 dB/oct
 620 - 700 Hz @ 0.85 g^2/Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.038 g^2/Hz

Composite = 28.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.050 g^2/Hz
 20 - 120 Hz @ +3 dB/oct
 120 - 1000 Hz @ 0.30 g^2/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.038 g^2/Hz

Composite = 19.8 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.015 g^2/Hz
 20 - 115 Hz @ +3 dB/oct
 115 Hz @ 0.082 g^2/Hz
 115 - 200 Hz @ +6 dB/oct
 200 - 715 Hz @ 0.25 g^2/Hz
 715 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.012 g^2/Hz

Composite = 15.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.024 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 150 Hz @ 0.12 g^2/Hz
 150 - 185 Hz @ -6 dB/oct
 185 - 1000 Hz @ 0.080 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 11.0 g_{rms}

8-3 (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
 20 - 120 Hz @ +3 dB/oct
 120 Hz @ 0.12 g^2/Hz
 120 - 250 Hz @ +6 dB/oct
 250 - 730 Hz @ 0.50 g^2/Hz
 730 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.025 g^2/Hz

Composite = 21.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.032 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 1000 Hz @ 0.16 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.040 g^2/Hz

Composite = 15.2 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.14 g^2/Hz
 20 - 73 Hz @ +3 dB/oct
 73 Hz @ 0.50 g^2/Hz
 73 - 250 Hz @ +6 dB/oct
 250 - 600 Hz @ 4.00 g^2/Hz
 600 - 620 Hz @ -12 dB/oct
 620 - 700 Hz @ 3.40 g^2/Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g^2/Hz

Composite = 56.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.20 g^2/Hz
 20 - 120 Hz @ +3 dB/oct
 120 - 1000 Hz @ 1.20 g^2/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g^2/Hz

Composite = 39.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

**Subzone 8-3-1 SRB Forward Skirt Skin and Stringers--Stations
433-395 (General Specifications)**

Same as Subzone 8-3-1-A below.

Subzone 8-3-1-A Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Stations 433-395. Weight of Component < 30 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0065 g^2/Hz
20 - 250 Hz @ +6 dB/oct
250 - 600 Hz @ 1.00 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0082 g^2/Hz

Composite = 25.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.020 g^2/Hz
150 - 225 Hz @ -9 dB/oct
225 - 1000 Hz @ 0.0058 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 3.2 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 200 Hz @ +6 dB/oct
200 - 600 Hz @ 0.25 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0020 g^2/Hz

Composite = 12.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.083 g^2/Hz
150 - 310 Hz @ -9 dB/oct
310 - 1000 Hz @ 0.0090 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

8-3-1-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial-Axis

20 Hz @ 0.0033 g^2/Hz
 20 - 250 Hz @ +6 dB/oct
 250 - 600 Hz @ 0.50 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0041 g^2/Hz

Composite = 17.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.066 g^2/Hz
 150 - 380 Hz @ -6 dB/oct
 380 - 1000 Hz @ 0.010 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.026 g^2/Hz
 20 - 250 Hz @ +6 dB/oct
 250 - 600 Hz @ 4.00 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.033 g^2/Hz

Composite = 50.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 150 Hz @ 0.080 g^2/Hz
 150 - 225 Hz @ -9 dB/oct
 225 - 1000 Hz @ 0.023 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0058 g^2/Hz

Composite = 6.4 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-1-B Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Stations 433-395. Weight of Component ≥ 30 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0065 g^2/Hz
 20 - 175 Hz @ +6 dB/oct
 175 - 600 Hz @ 0.50 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0040 g^2/Hz

Composite = 18.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00082 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.021 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0022 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0011 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.12 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0010 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.083 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0090 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

8-3-1-B (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
20 - 175 Hz @ +6 dB/oct
175 - 600 Hz @ 0.25 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0021 g^2/Hz

Composite = 13.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.066 g^2/Hz
150 - 380 Hz @ -6 dB/oct
380 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.026 g^2/Hz
20 - 175 Hz @ +6 dB/oct
175 - 600 Hz @ 2.00 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.016 g^2/Hz

Composite = 36.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 58 Hz @ +3 dB/oct
58 - 150 Hz @ 0.046 g^2/Hz
150 - 225 Hz @ -9 dB/oct
225 - 1000 Hz @ 0.014 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0035 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-1-C Input to Components Mounted on the SRB Forward Skirt Skin or Stringers--Statics 433-395. Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0065 g^2/Hz
 20 - 140 Hz @ +6 dB/oct
 140 - 600 Hz @ 0.32 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0028 g^2/Hz

Composite = 15.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00083 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.021 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0022 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0011 g^2/Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
 20 - 115 Hz @ +6 dB/oct
 115 - 600 Hz @ 0.080 g^2/Hz
 600 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.00065 g^2/Hz

Composite = 7.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0033 g^2/Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 150 Hz @ 0.083 g^2/Hz
 150 - 310 Hz @ -9 dB/oct
 310 - 1000 Hz @ 0.0090 g^2/Hz
 1000 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 5.0 g_{rms}

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8-3-1-C (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0033 g^2/Hz
20 - 140 Hz @ +6 dB/oct
140 - 600 Hz @ 0.16 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0013 g^2/Hz

Composite = 10.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 150 Hz @ 0.066 g^2/Hz
150 - 380 Hz @ -6 dB/oct
380 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0051 g^2/Hz

Composite = 5.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.026 g^2/Hz
20 - 140 Hz @ +6 dB/oct
140 - 600 Hz @ 1.30 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.011 g^2/Hz

Composite = 30.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 58 Hz @ +3 dB/oct
58 - 150 Hz @ 0.046 g^2/Hz
150 - 225 Hz @ -9 dB/oct
225 - 1000 Hz @ 0.014 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0035 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-2 SRB Forward Skirt Ring @ Station 424 (General Specifications)

Same as Subzone 8-3-2-A below.

Subzone 8-3-2-A Input to Components Mounted on the SRB Forward Skirt Ring @ Station 424. Weight of Component < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.035 g^2/Hz
 20 - 500 Hz @ +3 dB/oct.
 500 - 700 Hz @ 0.85 g^2/Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.038 g^2/Hz

Composite = 25.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.050 g^2/Hz
 20 - 120 Hz @ +3 dB/oct
 120 - 1000 Hz @ 0.30 g^2/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.038 g^2/Hz

Composite = 19.8 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.015 g^2/Hz
 20 - 150 Hz @ +3 dB/oct
 150 - 315 Hz @ 0.11 g^2/Hz
 315 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.18 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.012 g^2/Hz

Composite = 13.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.024 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 150 Hz @ 0.12 g^2/Hz
 150 - 185 Hz @ -6 dB/oct
 185 - 1000 Hz @ 0.080 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 11.0 g_{rms}

8-3-2-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.38 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 18.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.032 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.16 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.040 g^2/Hz

Composite = 15.2 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.14 g^2/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 3.40 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.15 g^2/Hz

Composite = 50.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.20 g^2/Hz
20 - 120 Hz @ +3 dB/oct
120 - 1000 Hz @ 1.20 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.15 g^2/Hz

Composite = 39.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-2-B Input to Components Mounted on the SRB Forward Skirt Ring @ Station 424. Weight of Component ≥ 20 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.035 \text{ g}^2/\text{Hz}$
 20 - 340 Hz @ +3 dB/oct
 340 - 700 Hz @ $0.58 \text{ g}^2/\text{Hz}$
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.025 \text{ g}^2/\text{Hz}$

Composite = $21.9 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.050 \text{ g}^2/\text{Hz}$
 20 - 80 Hz @ +3 dB/oct
 80 - 1000 Hz @ $0.20 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.025 \text{ g}^2/\text{Hz}$

Composite = $16.3 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.015 \text{ g}^2/\text{Hz}$
 20 - 100 Hz @ +3 dB/oct
 100 - 260 Hz @ $0.073 \text{ g}^2/\text{Hz}$
 260 - 330 Hz @ +6 dB/oct
 330 - 800 Hz @ $0.12 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.0077 \text{ g}^2/\text{Hz}$

Composite = $10.9 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.024 \text{ g}^2/\text{Hz}$
 20 - 63 Hz @ +3 dB/oct
 63 - 150 Hz @ $0.075 \text{ g}^2/\text{Hz}$
 150 - 185 Hz @ -6 dB/oct
 185 - 1000 Hz @ $0.050 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.013 \text{ g}^2/\text{Hz}$

Composite = $8.8 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ $0.019 \text{ g}^2/\text{Hz}$
 20 - 260 Hz @ +3 dB/oct
 260 - 800 Hz @ $0.25 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.016 \text{ g}^2/\text{Hz}$

Composite = $15.9 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.032 \text{ g}^2/\text{Hz}$
 20 - 62 Hz @ +3 dB/oct
 62 - 1000 Hz @ $0.10 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.025 \text{ g}^2/\text{Hz}$

Composite = $12.1 \text{ g}_{\text{rms}}$

8-3-2-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.14 g^2/Hz
20 - 340 Hz @ +3 dB/oct
340 - 700 Hz @ 2.30 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 43.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.20 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 1000 Hz @ 0.80 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 32.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-2-C Input to Components Mounted on the SRB Forward Skirt Ring @ Station 424. Weight of Component ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.035 g^2/Hz
 20 - 210 Hz @ +3 dB/oct
 210 - 700 Hz @ 0.35 g^2/Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.016 g^2/Hz

Composite = 17.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.032 g^2/Hz
 20 - 80 Hz @ +3 dB/oct
 80 - 1000 Hz @ 0.12 g^2/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.016 g^2/Hz

Composite = 12.9 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.015 g^2/Hz
 20 - 65 Hz @ +3 dB/oct
 65 - 200 Hz @ 0.047 g^2/Hz
 200 - 260 Hz @ +6 dB/oct
 260 - 800 Hz @ 0.077 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0050 g^2/Hz

Composite = 8.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.024 g^2/Hz
 20 - 42 Hz @ +3 dB/oct
 42 - 150 Hz @ 0.050 g^2/Hz
 150 - 185 Hz @ -6 dB/oct
 185 - 1000 Hz @ 0.033 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0083 g^2/Hz

Composite = 7.1 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
 20 - 170 Hz @ +3 dB/oct
 170 - 800 Hz @ 0.16 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 13.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.032 g^2/Hz
 20 - 42 Hz @ +3 dB/oct
 42 - 1000 Hz @ 0.067 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.017 g^2/Hz

Composite = 9.9 g_{rms}

8-3-2-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ $0.14 \text{ g}^2/\text{Hz}$
20 - 210 Hz @ +3 dB/oct
210 - 700 Hz @ $1.40 \text{ g}^2/\text{Hz}$
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.061 \text{ g}^2/\text{Hz}$

Composite = $35.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.13 \text{ g}^2/\text{Hz}$
20 - 80 Hz @ +3 dB/oct
80 - 1000 Hz @ $0.50 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.063 \text{ g}^2/\text{Hz}$

Composite = $25.8 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-3 SRB Forward Skirt Ring @ Station 401 (General Specifications)

Same as Subzone 8-3-3-A below.

Subzone 8-3-3-A Input to Components Mounted on the SRB Forward Skirt Ring @ Station 401. Weight of Component < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 0.32 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.014 g^2/Hz

Composite = 15.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 1000 Hz @ 0.12 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 12.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0054 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 320 Hz @ 0.040 g^2/Hz
320 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.065 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0042 g^2/Hz

Composite = 7.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.010 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.050 g^2/Hz
150 - 190 Hz @ -6 dB/oct
190 - 1000 Hz @ 0.030 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0075 g^2/Hz

Composite = 6.8 g_{rms}

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8-3-3-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0071 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.14 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0090 g^2/Hz

Composite = 11.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.060 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 9.3 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 1.30 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.056 g^2/Hz

Composite = 31.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.064 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 1000 Hz @ 0.48 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.060 g^2/Hz

Composite = 25.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-3-B Input to Components Mounted on the SRB Forward Skirt Ring @ Station 401. Weight of Component
 ≥ 20 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.013 \text{ g}^2/\text{Hz}$
 20 - 350 Hz @ +3 dB/oct
 350 - 700 Hz @ $0.22 \text{ g}^2/\text{Hz}$
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.0098 \text{ g}^2/\text{Hz}$

Composite = $13.7 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.016 \text{ g}^2/\text{Hz}$
 20 - 100 Hz @ +3 dB/oct
 100 - 1000 Hz @ $0.080 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$

Composite = $10.3 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.0054 \text{ g}^2/\text{Hz}$
 20 - 100 Hz @ +3 dB/oct
 100 - 250 Hz @ $0.026 \text{ g}^2/\text{Hz}$
 250 - 320 Hz @ +6 dB/oct
 320 - 800 Hz @ $0.043 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.0028 \text{ g}^2/\text{Hz}$

Composite = $6.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.010 \text{ g}^2/\text{Hz}$
 20 - 65 Hz @ +3 dB/oct
 65 - 150 Hz @ $0.033 \text{ g}^2/\text{Hz}$
 150 - 190 Hz @ -6 dB/oct
 190 - 1000 Hz @ $0.020 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.0050 \text{ g}^2/\text{Hz}$

Composite = $5.6 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ $0.0071 \text{ g}^2/\text{Hz}$
 20 - 260 Hz @ +3 dB/oct
 260 - 800 Hz @ $0.092 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.0060 \text{ g}^2/\text{Hz}$

Composite = $9.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.012 \text{ g}^2/\text{Hz}$
 20 - 66 Hz @ +3 dB/oct
 66 - 1000 Hz @ $0.040 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$

Composite = $7.7 \text{ g}_{\text{rms}}$

8-3-3-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 350 Hz @ +3 dB/oct
350 - 700 Hz @ 0.90 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.039 g^2/Hz

Composite = 27.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.064 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.32 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.040 g^2/Hz

Composite = 20.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-3-3-C Input to Components Mounted on the SRB Forward Skirt Ring @ Station 401. Weight of Component
 ≥ 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0088 g^2/Hz
 20 - 320 Hz @ +3 dB/oct
 320 - 700 Hz @ 0.14 g^2/Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0060 g^2/Hz

Composite = 10.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.010 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 1000 Hz @ 0.050 g^2/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0062 g^2/Hz

Composite = 8.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0054 g^2/Hz
 20 - 60 Hz @ +3 dB/oct
 60 - 200 Hz @ 0.016 g^2/Hz
 200 - 260 Hz @ +6 dB/oct
 260 - 800 Hz @ 0.027 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0018 g^2/Hz

Composite = 5.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.010 g^2/Hz
 20 - 52 Hz @ +3 dB/oct
 52 - 150 Hz @ 0.026 g^2/Hz
 150 - 190 Hz @ -6 dB/oct
 190 - 1000 Hz @ 0.016 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0040 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0071 g^2/Hz
 20 - 160 Hz @ +3 dB/oct
 160 - 800 Hz @ 0.058 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0038 g^2/Hz

Composite = 7.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
 20 - 42 Hz @ +3 dB/oct
 42 - 1000 Hz @ 0.025 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0063 g^2/Hz

Composite = 6.1 g_{rms}

8-3-3-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.035 g^2/Hz
20 - 320 Hz @ +3 dB/oct
320 - 700 Hz @ 0.56 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.024 g^2/Hz

Composite = 21.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.040 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 16.3 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-4 SRB Forward Skirt Bulkhead (General Specifications)

Same as Subzone 8-4-A below.

Subzone 8-4-A Input to Components Mounted on the SRB Forward Skirt Bulkhead. Weight of Component < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0075 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 63 Hz @ 0.015 g^2/Hz
63 - 200 Hz @ +9 dB/oct
200 - 500 Hz @ 0.45 g^2/Hz
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0072 g^2/Hz

Composite = 16.2 g_{rms}

Directions B and C

20 Hz @ 0.0019 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 63 Hz @ 0.0038 g^2/Hz
63 - 200 Hz @ +9 dB/oct
200 - 500 Hz @ 0.11 g^2/Hz
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0018 g^2/Hz

Composite = 8.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Direction A

20 Hz @ 0.00030 g^2/Hz
20 - 200 Hz @ +9 dB/oct
200 - 500 Hz @ 0.30 g^2/Hz
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0048 g^2/Hz

Composite = 13.3 g_{rms}

Directions B and C

20 Hz @ 0.000075 g^2/Hz
20 - 200 Hz @ +9 dB/oct
200 - 500 Hz @ 0.075 g^2/Hz
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0012 g^2/Hz

Composite = 6.7 g_{rms}

8-4-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Direction A

20 Hz @ 0.010 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 115 Hz @ 0.020 g^2/Hz
115 - 250 Hz @ +15 dB/oct
250 - 400 Hz @ 1.00 g^2/Hz
400 - 1150 Hz @ -12 dB/oct
1150 - 1500 Hz @ 0.015 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.011 g^2/Hz

Composite = 18.3 g_{rms}

Directions B and C

20 Hz @ 0.0025 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 115 Hz @ 0.0050 g^2/Hz
115 - 250 Hz @ +15 dB/oct
250 - 400 Hz @ 0.25 g^2/Hz
400 - 1150 Hz @ -12 dB/oct
1150 - 1500 Hz @ 0.0038 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0028 g^2/Hz

Composite = 9.1 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Direction A

20 Hz @ 0.030 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 63 Hz @ 0.060 g^2/Hz
63 - 200 Hz @ +9 dB/oct
200 - 500 Hz @ 1.80 g^2/Hz
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.029 g^2/Hz

Composite = 32.5 g_{rms}

Directions B and C

20 Hz @ 0.0075 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 63 Hz @ 0.015 g^2/Hz
63 - 200 Hz @ +9 dB/oct
200 - 500 Hz @ 0.45 g^2/Hz
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0072 g^2/Hz

Composite = 16.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

8-4-A (Cont.)

6. Shock Test Criteria (2 shocks/axis)

See Tables VII, IX and X.

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

Subzone 8-4-B Input to Components Mounted on the SRB Forward Skirt Bulkhead. Weight of Component ≥ 20 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.0075 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 56 Hz @ 0.011 g^2/Hz
 56 - 146 Hz @ +9 dB/oct
 146 - 500 Hz @ 0.21 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0033 g^2/Hz

Composite = 11.4 g_{rms}

Directions B and C

20 Hz @ 0.0019 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 56 Hz @ 0.0028 g^2/Hz
 56 - 146 Hz @ +9 dB/oct
 146 - 500 Hz @ 0.053 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.00083 g^2/Hz

Composite = 5.7 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Direction A

20 Hz @ 0.00030 g^2/Hz
 20 - 160 Hz @ +9 dB/oct
 160 - 500 Hz @ 0.14 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0022 g^2/Hz

Composite = 9.3 g_{rms}

Directions B and C

20 Hz @ 0.000075 g^2/Hz
 20 - 170 Hz @ +9 dB/oct
 170 - 500 Hz @ 0.042 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.00067 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Direction A

20 Hz @ 0.010 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 105 Hz @ 0.015 g^2/Hz
 105 - 210 Hz @ +15 dB/oct
 210 - 400 Hz @ 0.46 g^2/Hz
 400 - 1150 Hz @ -12 dB/oct
 1150 - 1500 Hz @ 0.0070 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0052 g^2/Hz

Composite = 13.0 g_{rms}

Directions B and C

20 Hz @ 0.0025 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 105 Hz @ 0.0038 g^2/Hz
 105 - 210 Hz @ +15 dB/oct
 210 - 400 Hz @ 0.12 g^2/Hz
 400 - 1150 Hz @ -12 dB/oct
 1150 - 1500 Hz @ 0.0018 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0013 g^2/Hz

Composite = 6.5 g_{rms}

8-4-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Direction A

20 Hz @ $0.030 \text{ g}^2/\text{Hz}$
20 - 30 Hz @ +3 dB/oct
30 - 56 Hz @ $0.045 \text{ g}^2/\text{Hz}$
56 - 146 Hz @ +9 dB/oct
146 - 500 Hz @ $0.83 \text{ g}^2/\text{Hz}$
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.013 \text{ g}^2/\text{Hz}$

Composite = $22.8 \text{ g}_{\text{rms}}$

Directions B and C

20 Hz @ $0.0075 \text{ g}^2/\text{Hz}$
20 - 30 Hz @ +3 dB/oct
30 - 56 Hz @ $0.011 \text{ g}^2/\text{Hz}$
56 - 146 Hz @ +9 dB/oct
146 - 500 Hz @ $0.21 \text{ g}^2/\text{Hz}$
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0033 \text{ g}^2/\text{Hz}$

Composite = $11.4 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VII, IX and X.

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 8-4-C Input to Components Mounted on the SRB Forward Skirt Bulkhead. Weight of Component \geq 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 - 46 Hz @ 0.0060 g^2/Hz
 46 - 115 Hz @ +9 dB/oct
 115 - 500 Hz @ 0.090 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0014 g^2/Hz

Composite = 7.6 g_{rms}

Directions B and C

20 - 46 Hz @ 0.0015 g^2/Hz
 46 - 115 Hz @ +9 dB/oct
 115 - 500 Hz @ 0.023 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.00035 g^2/Hz

Composite = 3.8 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Direction A

20 Hz @ 0.00030 g^2/Hz
 20 - 120 Hz @ +9 dB/oct
 120 - 500 Hz @ 0.060 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.00095 g^2/Hz

Composite = 6.2 g_{rms}

Directions B and C

20 Hz @ 0.000075 g^2/Hz
 20 - 170 Hz @ +9 dB/oct
 170 - 500 Hz @ 0.042 g^2/Hz
 500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.00067 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Direction A

20 - 95 Hz @ 0.010 g^2/Hz
 95 - 175 Hz @ +15 dB/oct
 175 - 400 Hz @ 0.20 g^2/Hz
 400 - 1150 Hz @ -12 dB/oct
 1150 - 1500 Hz @ 0.0030 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.0022 g^2/Hz

Composite = 8.9 g_{rms}

Directions B and C

20 - 95 Hz @ 0.0032 g^2/Hz
 95 - 175 Hz @ +15 dB/oct
 175 - 400 Hz @ 0.063 g^2/Hz
 400 - 1150 Hz @ -12 dB/oct
 1150 - 1500 Hz @ 0.00095 g^2/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.00073 g^2/Hz

Composite = 5.0 g_{rms}

8-4-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Direction A

20 - 46 Hz @ $0.024 \text{ g}^2/\text{Hz}$
46 - 115 Hz @ +9 dB/oct
115 - 500 Hz @ $0.36 \text{ g}^2/\text{Hz}$
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0057 \text{ g}^2/\text{Hz}$

Composite = $15.3 \text{ g}_{\text{rms}}$

Directions B and C

20 - 46 Hz @ $0.0060 \text{ g}^2/\text{Hz}$
46 - 115 Hz @ +9 dB/oct
115 - 500 Hz @ $0.090 \text{ g}^2/\text{Hz}$
500 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0014 \text{ g}^2/\text{Hz}$

Composite = $7.7 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VII, IX and X.

Direction A--Perpendicular to Bulkhead

Direction B--Tangential to Bulkhead

Direction C--Tangential to Bulkhead, Perpendicular to Direction B

* Design Criteria Only

Subzone 8-5

SRB Forward Skirt Avionics Panels (General Specifications)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.022 g^2/Hz
 20 - 43 Hz @ +6 dB/oct
 43 - 300 Hz @ 0.10 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1200 Hz @ 0.015 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0055 g^2/Hz

Composite = 7.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0078 g^2/Hz
 20 - 39 Hz @ +3 dB/oct
 39 - 102 Hz @ 0.015 g^2/Hz
 102 - 187 Hz @ +6 dB/oct
 187 - 1500 Hz @ 0.050 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.028 g^2/Hz

Composite = 9.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
 20 - 40 Hz @ +6 dB/oct
 40 - 300 Hz @ 0.20 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1500 Hz @ 0.030 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.017 g^2/Hz

Composite = 11.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.045 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 1000 Hz @ 0.090 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 11.5 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.088 g^2/Hz
 20 - 43 Hz @ +6 dB/oct
 43 - 300 Hz @ 0.40 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1200 Hz @ 0.060 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 15.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.031 g^2/Hz
 20 - 39 Hz @ +3 dB/oct
 39 - 102 Hz @ 0.060 g^2/Hz
 102 - 187 Hz @ +6 dB/oct
 187 - 1500 Hz @ 0.20 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.11 g^2/Hz

Composite = 18.9 g_{rms}

8-5 (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

	20 Hz @ 0.35 g^2/Hz
20 -	38 Hz @ +6 dB/oct
38 -	60 Hz @ 1.30 g^2/Hz
60 -	80 Hz @ -12 dB/oct
80 -	230 Hz @ 0.46 g^2/Hz
230 -	2000 Hz @ -6 dB/oct
	2000 Hz @ 0.0065 g^2/Hz

Composite = 14.8 g_{rms}

Long. and Tang. Axes

	20 Hz @ 0.60 g^2/Hz
20 -	30 Hz @ +3 dB/oct
30 -	50 Hz @ 0.90 g^2/Hz
50 -	80 Hz @ -12 dB/oct
80 -	500 Hz @ 0.15 g^2/Hz
500 -	2000 Hz @ -3 dB/oct
	2000 Hz @ 0.036 g^2/Hz

Composite = 14.3 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 -	5 Hz @ 1.0 G's peak*
5 -	40 Hz @ 1.0 G's peak

Lateral Axes

2 -	5 Hz @ 1.7 G's peak*
5 -	10 Hz @ 0.6 G's peak
10 -	40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, VI, IX and X.

* Design Criteria Only

Subzone 8-5-A Input to SRB Forward Skirt Avionics Panels. Total
Weight of Panel and Components < 80 lb.

1. - Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 140 Hz @ +3 dB/oct
140 - 300 Hz @ 0.10 g^2/Hz
300 - 775 Hz @ -6 dB/oct
775 - 1200 Hz @ 0.015 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0055 g^2/Hz

Composite = 7.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0075 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 135 Hz @ 0.015 g^2/Hz
135 - 250 Hz @ +6 dB/oct
250 - 400 Hz @ 0.050 g^2/Hz
400 - 520 Hz @ -15 dB/oct
520 - 700 Hz @ 0.015 g^2/Hz
700 - 900 Hz @ +15 dB/oct
900 - 1500 Hz @ 0.050 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.028 g^2/Hz

Composite = 8.6 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 110 Hz @ +3 dB/oct
110 - 300 Hz @ 0.20 g^2/Hz
300 - 775 Hz @ -6 dB/oct
775 - 1500 Hz @ 0.030 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.017 g^2/Hz

Composite = 10.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.045 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 400 Hz @ 0.090 g^2/Hz
400 - 500 Hz @ -15 dB/oct
500 - 600 Hz @ 0.030 g^2/Hz
600 - 750 Hz @ +15 dB/oct
750 - 1000 Hz @ 0.090 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.022 g^2/Hz

Composite = 10.9 g_{rms}

8-5-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.057 g^2/Hz
 20 - 140 Hz @ +3 dB/oct
 140 - 300 Hz @ 0.40 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1200 Hz @ 0.060 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 14.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.030 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 135 Hz @ 0.060 g^2/Hz
 135 - 250 Hz @ +6 dB/oct
 250 - 400 Hz @ 0.20 g^2/Hz
 400 - 520 Hz @ -15 dB/oct
 520 - 700 Hz @ 0.060 g^2/Hz
 700 - 900 Hz @ +15 dB/oct
 900 - 1500 Hz @ 0.20 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.11 g^2/Hz

Composite = 17.2 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.35 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 0.70 g^2/Hz
 60 - 68 Hz @ -9 dB/oct
 68 - 230 Hz @ 0.46 g^2/Hz
 230 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0065 g^2/Hz

Composite = 14.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.60 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 50 Hz @ 0.90 g^2/Hz
 50 - 80 Hz @ -12 dB/oct
 80 - 360 Hz @ 0.15 g^2/Hz
 360 - 480 Hz @ -15 dB/oct
 480 - 600 Hz @ 0.040 g^2/Hz
 600 - 750 Hz @ +9 dB/oct
 750 - 900 Hz @ 0.080 g^2/Hz
 900 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.036 g^2/Hz

Composite = 13.0 g_{rms}

8-5-A (Cont.)

5. Vehicle Dynamics Criteria

Lateral Axes

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

*Design Criteria Only

Subzone 8-5-A-1 Input to Components Mounted on the SRB Forward Skirt Avionics Panels. Total Weight of Components On Panel < 20 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.016 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 300 Hz @ 0.10 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1200 Hz @ 0.015 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0055 g^2/Hz

Composite = 7.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0075 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 135 Hz @ 0.015 g^2/Hz
 135 - 250 Hz @ +6 dB/oct
 250 - 1500 Hz @ 0.050 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.028 g^2/Hz

Composite = 9.3 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
 20 - 40 Hz @ +6 dB/oct
 40 - 300 Hz @ 0.20 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1500 Hz @ 0.030 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.017 g^2/Hz

Composite = 11.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.045 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 1000 Hz @ 0.090 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 11.5 g_{rms}

3. Boost Random Vibration Criteria (30 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.065 g^2/Hz
 20 - 50 Hz @ +6 dB/oct
 50 - 300 Hz @ 0.40 g^2/Hz
 300 - 775 Hz @ -6 dB/oct
 775 - 1200 Hz @ 0.060 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 15.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.030 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 135 Hz @ 0.060 g^2/Hz
 135 - 250 Hz @ +6 dB/oct
 250 - 1500 Hz @ 0.20 g^2/Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.11 g^2/Hz

Composite = 18.6 g_{rms}

8-5-A-1 (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.35 g^2/Hz
 20 - 38 Hz @ +6 dB/oct
 38 - 60 Hz @ 1.30 g^2/Hz
 60 - 80 Hz @ -12 dB/oct
 80 - 230 Hz @ 0.46 g^2/Hz
 230 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0065 g^2/Hz

Composite = 14.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.60 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 50 Hz @ 0.90 g^2/Hz
 50 - 80 Hz @ -12 dB/oct
 80 - 500 Hz @ 0.15 g^2/Hz
 500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.036 g^2/Hz

Composite = 14.3 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Table VI, IX and X.

* Design Criteria Only

Subzone 8-5-B Input to SRB Forward Skirt Avionics Panels. Total
Weight of Panel and Components ≥ 80 but < 120 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 125 Hz @ +3 dB/oct
125 - 300 Hz @ 0.088 g^2/Hz
300 - 800 Hz @ -6 dB/oct
800 - 1200 Hz @ 0.012 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 6.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0075 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ 0.015 g^2/Hz
120 - 200 Hz @ +6 dB/oct
200 - 350 Hz @ 0.042 g^2/Hz
350 - 450 Hz @ -15 dB/oct
450 - 550 Hz @ 0.012 g^2/Hz
550 - 700 Hz @ +15 dB/oct
700 - 1400 Hz @ 0.042 g^2/Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2/Hz

Composite = 8.0 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in
each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 300 Hz @ 0.18 g^2/Hz
300 - 800 Hz @ -6 dB/oct
800 - 1300 Hz @ 0.025 g^2/Hz
1300 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 10.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.040 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 340 Hz @ 0.080 g^2/Hz
340 - 420 Hz @ -15 dB/oct
420 - 560 Hz @ 0.025 g^2/Hz
560 - 700 Hz @ +15 dB/oct
700 - 1000 Hz @ 0.080 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2/Hz

Composite = 10.2 g_{rms}

8-5-B (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.057 g^2/Hz
 20 - 125 Hz @ +3 dB/oct
 125 - 300 Hz @ 0.35 g^2/Hz
 300 - 800 Hz @ -6 dB/oct
 800 - 1200 Hz @ 0.050 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.018 g^2/Hz

Composite = 13.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.030 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.060 g^2/Hz
 120 - 200 Hz @ +6 dB/oct
 200 - 350 Hz @ 0.17 g^2/Hz
 350 - 450 Hz @ -15 dB/oct
 450 - 550 Hz @ 0.050 g^2/Hz
 550 - 700 Hz @ +15 dB/oct
 700 - 1400 Hz @ 0.17 g^2/Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.082 g^2/Hz

Composite = 16.1 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.35 g^2/Hz
 20 - 34 Hz @ +3 dB/oct
 34 - 50 Hz @ 0.60 g^2/Hz
 50 - 58 Hz @ -9 dB/oct
 58 - 230 Hz @ 0.40 g^2/Hz
 230 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0056 g^2/Hz

Composite = 13.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.58 g^2/Hz
 20 - 28 Hz @ +3 dB/oct
 28 - 40 Hz @ 0.80 g^2/Hz
 40 - 65 Hz @ -12 dB/oct
 65 - 340 Hz @ 0.13 g^2/Hz
 340 - 450 Hz @ -15 dB/oct
 450 - 600 Hz @ 0.030 g^2/Hz
 600 - 700 Hz @ +15 dB/oct
 700 - 800 Hz @ 0.070 g^2/Hz
 800 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.028 g^2/Hz

Composite = 11.6 g_{rms}

8-5-B (Cont.)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X.

* Design Criteria Only

Subzone 8-5-B-1 Input to Components Mounted on the SRB Forward Skirt Avionics Panels. Total Weight of Components On Panel ≥ 20 but < 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.022 g^2/Hz
 20 - 40 Hz @ +6 dB/oct
 40 - 300 Hz @ 0.088 g^2/Hz
 300 - 800 Hz @ -6 dB/oct
 800 - 1200 Hz @ 0.012 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0045 g^2/Hz

Composite = 7.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0075 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.015 g^2/Hz
 120 - 200 Hz @ +6 dB/oct
 200 - 1400 Hz @ 0.042 g^2/Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 8.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
 20 - 38 Hz @ +6 dB/oct
 38 - 300 Hz @ 0.18 g^2/Hz
 300 - 800 Hz @ -6 dB/oct
 800 - 1300 Hz @ 0.025 g^2/Hz
 1300 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 10.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.040 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 1000 Hz @ 0.080 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.020 g^2/Hz

Composite = 10.9 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.088 g^2/Hz
 20 - 40 Hz @ +6 dB/oct
 40 - 300 Hz @ 0.35 g^2/Hz
 300 - 800 Hz @ -6 dB/oct
 800 - 1200 Hz @ 0.050 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.018 g^2/Hz

Composite = 14.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.030 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.060 g^2/Hz
 120 - 200 Hz @ +6 dB/oct
 200 - 1400 Hz @ 0.17 g^2/Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.082 g^2/Hz

Composite = 17.0 g_{rms}

8-5-B-1 (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.35 g^2/Hz
20 - 36 Hz @ +6 dB/oct
36 - 60 Hz @ 1.20 g^2/Hz
60 - 80 Hz @ -12 dB/oct
80 - 230 Hz @ 0.40 g^2/Hz
230 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2/Hz

Composite = 13.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.58 g^2/Hz
20 - 28 Hz @ +3 dB/oct
28 - 40 Hz @ 0.80 g^2/Hz
40 - 65 Hz @ -12 dB/oct
65 - 450 Hz @ 0.13 g^2/Hz
450 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.028 g^2/Hz

Composite = 12.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VI, IX and X.

* Design Criteria Only

**Subzone 8-5-C Input to SRB Forward Skirt Avionics Panels. Total
Weight of Panel and Components ≥ 120 lb.**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 250 Hz @ 0.070 g^2/Hz
250 - 670 Hz @ -6 dB/oct
670 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0025 g^2/Hz

Composite = 5.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0078 g^2/Hz
20 - 32 Hz @ +3 dB/oct
32 - 94 Hz @ 0.012 g^2/Hz
94 - 150 Hz @ +6 dB/oct
150 - 300 Hz @ 0.032 g^2/Hz
300 - 380 Hz @ -15 dB/oct
380 - 510 Hz @ 0.010 g^2/Hz
510 - 650 Hz @ +15 dB/oct
650 - 1000 Hz @ 0.032 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0082 g^2/Hz

Composite = 6.3 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.030 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 250 Hz @ 0.15 g^2/Hz
250 - 675 Hz @ -6 dB/oct
675 - 1200 Hz @ 0.020 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0070 g^2/Hz

Composite = 8.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.034 g^2/Hz
20 - 36 Hz @ +3 dB/oct
36 - 300 Hz @ 0.060 g^2/Hz
300 - 370 Hz @ -15 dB/oct
370 - 520 Hz @ 0.020 g^2/Hz
520 - 650 Hz @ +15 dB/oct
650 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 8.8 g_{rms}

8-5-C (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.056 g^2/Hz
 20 - 100 Hz @ +3 dB/oct
 100 - 250 Hz @ 0.28 g^2/Hz
 250 - 670 Hz @ -6 dB/oct
 670 - 1000 Hz @ 0.040 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 11.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.031 g^2/Hz
 20 - 32 Hz @ +3 dB/oct
 32 - 94 Hz @ 0.050 g^2/Hz
 94 - 150 Hz @ +6 dB/oct
 150 - 300 Hz @ 0.13 g^2/Hz
 300 - 380 Hz @ -15 dB/oct
 380 - 510 Hz @ 0.040 g^2/Hz
 510 - 650 Hz @ +15 dB/oct
 650 - 1000 Hz @ 0.13 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.033 g^2/Hz

Composite = 12.7 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.34 g^2/Hz
 20 - 30 Hz @ +3 dB/oct
 30 - 50 Hz @ 0.50 g^2/Hz
 50 - 58 Hz @ -9 dB/oct
 58 - 200 Hz @ 0.32 g^2/Hz
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0036 g^2/Hz

Composite = 10.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.60 g^2/Hz
 40 - 60 Hz @ -12 dB/oct
 60 - 300 Hz @ 0.10 g^2/Hz
 300 - 400 Hz @ -15 dB/oct
 400 - 500 Hz @ 0.025 g^2/Hz
 500 - 600 Hz @ +12 dB/oct
 600 - 800 Hz @ 0.054 g^2/Hz
 800 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.021 g^2/Hz

Composite = 10.2 g_{rms}

8-5-C (Cont.)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables V, IX and X

*Design Criteria Only

Subzone 8-5-C-1 Input to Components Mounted on the SRB Forward Skirt Avionics Panels. Total Weight of Components On Panel \geq 60 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.085 g^2/Hz
 20 - 34 Hz @ +6 dB/oct
 34 - 60 Hz @ 0.25 g^2/Hz
 60 - 80 Hz @ -12 dB/oct
 80 - 200 Hz @ 0.080 g^2/Hz
 200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.00090 g^2/Hz

Composite = 5.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0078 g^2/Hz
 20 - 32 Hz @ +3 dB/oct
 32 - 94 Hz @ 0.012 g^2/Hz
 94 - 150 Hz @ +6 dB/oct
 150 - 1000 Hz @ 0.032 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0082 g^2/Hz

Composite = 6.8 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
 20 - 34 Hz @ +6 dB/oct
 34 - 250 Hz @ 0.15 g^2/Hz
 250 - 675 Hz @ -6 dB/oct
 675 - 1200 Hz @ 0.020 g^2/Hz
 1200 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0070 g^2/Hz

Composite = 8.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.034 g^2/Hz
 20 - 36 Hz @ +3 dB/oct
 36 - 1000 Hz @ 0.060 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.015 g^2/Hz

Composite = 9.4 g_{rms}

3. Boost Random Vibration Criteria (80 sec. plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.086 g^2/Hz
 20 - 36 Hz @ +6 dB/oct
 36 - 250 Hz @ 0.28 g^2/Hz
 250 - 670 Hz @ -6 dB/oct
 670 - 1000 Hz @ 0.040 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.010 g^2/Hz

Composite = 11.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.031 g^2/Hz
 20 - 32 Hz @ +3 dB/oct
 32 - 94 Hz @ 0.050 g^2/Hz
 94 - 150 Hz @ +6 dB/oct
 150 - 1000 Hz @ 0.13 g^2/Hz
 1000 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.033 g^2/Hz

Composite = 13.6 g_{rms}

8-5-C-1 (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.34 g^2/Hz
20 - 34 Hz @ +6 dB/oct
34 - 60 Hz @ 1.00 g^2/Hz
60 - 80 Hz @ -12 dB/oct
80 - 200 Hz @ 0.32 g^2/Hz
200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0036 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 - 40 Hz @ 0.60 g^2/Hz
40 - 60 Hz @ -12 dB/oct
60 - 420 Hz @ 0.10 g^2/Hz
420 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.021 g^2/Hz

Composite = 10.9 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VI, IX and X.

* Design Criteria Only

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Zone 9 SRB Nose Cone

Subzone 9-1 SRB Frustum--Stations 395-275 (General Specifications)

Same as Subzone 9-1-A below.

Subzone 9-1-A Input to Components Mounted on the SRB Frustum--
Stations 395-275. Weight of Component <10 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 60 Hz @ 0.075 g^2/Hz
60 - 72 Hz @ -6 dB/oct
72 - 600 Hz @ 0.050 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 6.6 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.020 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0013 g^2/Hz

Composite = 4.7 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.017 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 800 Hz @ 0.034 g^2/Hz
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00088 g^2/Hz

Composite = 5.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.011 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 900 Hz @ 0.022 g^2/Hz
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00090 g^2/Hz

Composite = 5.0 g_{rms}

9-1-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.025 g^2/Hz
 120 - 180 Hz @ +9 dB/oct
 180 - 800 Hz @ 0.090 g^2/Hz
 800 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0023 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0030 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.0060 g^2/Hz
 120 - 180 Hz @ +9 dB/oct
 180 - 1100 Hz @ 0.023 g^2/Hz
 1100 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.0023 g^2/Hz

Composite = 5.4 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 60 Hz @ 0.30 g^2/Hz
 60 - 72 Hz @ -6 dB/oct
 72 - 600 Hz @ 0.20 g^2/Hz
 600 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0055 g^2/Hz

Composite = 13.2 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.080 g^2/Hz
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0052 g^2/Hz

Composite = 9.5 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
 5 - 10 Hz @ 0.7 G's peak
 10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
 5 - 10 Hz @ 0.5 G's peak
 10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VIII, IX and X.

* Design Criteria Only

Subzone 9-1-B Input to Components Mounted on the SRB Frustum--
Stations 395-275. Weight of Component ≥ 10 but
 < 25 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 50 Hz @ $0.050 \text{ g}^2/\text{Hz}$
 50 - 62 Hz @ -6 dB/oct
 62 - 600 Hz @ $0.032 \text{ g}^2/\text{Hz}$
 600 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.00090 \text{ g}^2/\text{Hz}$

Composite = $5.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 800 Hz @ $0.014 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -9 dB/oct
 2000 Hz @ $0.00088 \text{ g}^2/\text{Hz}$

Composite = $3.9 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.017 \text{ g}^2/\text{Hz}$
 20 - 28 Hz @ +3 dB/oct
 28 - 800 Hz @ $0.023 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.00069 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.011 \text{ g}^2/\text{Hz}$
 20 - 40 Hz @ +3 dB/oct
 40 - 900 Hz @ $0.022 \text{ g}^2/\text{Hz}$
 900 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.00090 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ $0.013 \text{ g}^2/\text{Hz}$
 20 - 27 Hz @ +3 dB/oct
 27 - 120 Hz @ $0.017 \text{ g}^2/\text{Hz}$
 120 - 180 Hz @ +9 dB/oct
 180 - 800 Hz @ $0.060 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.0016 \text{ g}^2/\text{Hz}$

Composite = $7.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0028 \text{ g}^2/\text{Hz}$
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ $0.0051 \text{ g}^2/\text{Hz}$
 120 - 180 Hz @ +9 dB/oct
 180 - 1100 Hz @ $0.020 \text{ g}^2/\text{Hz}$
 1100 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.0023 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

9-1-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 50 Hz @ 0.20 g^2/Hz
50 - 62 Hz @ -6 dB/oct
62 - 600 Hz @ 0.13 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0036 g^2/Hz

Composite = 10.7 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.054 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0035 g^2/Hz

Composite = 7.8 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VIII, IX and X.

* Design Criteria Only

Subzone 9-1-C Input to Components Mounted on the SRB Frustum--
Stations 395-275. Weight of Component ≥ 25 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 40 Hz @ $0.032 \text{ g}^2/\text{Hz}$
40 - 50 Hz @ -6 dB/oct
50 - 600 Hz @ $0.021 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00058 \text{ g}^2/\text{Hz}$

Composite = $4.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 800 Hz @ $0.0082 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00052 \text{ g}^2/\text{Hz}$

Composite = $3.0 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.017 \text{ g}^2/\text{Hz}$
20 - 28 Hz @ +3 dB/oct
28 - 800 Hz @ $0.023 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00069 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.011 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/oct
40 - 900 Hz @ $0.022 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00090 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 120 Hz @ $0.012 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 800 Hz @ $0.009 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0010 \text{ g}^2/\text{Hz}$

Composite = $6.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0028 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ $0.0051 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 1100 Hz @ $0.020 \text{ g}^2/\text{Hz}$
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0023 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

9-1-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 40 Hz @ $0.13 \text{ g}^2/\text{Hz}$
40 - 50 Hz @ -6 dB/oct
50 - 600 Hz @ $0.085 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0023 \text{ g}^2/\text{Hz}$

Composite = $8.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 800 Hz @ $0.033 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0021 \text{ g}^2/\text{Hz}$

Composite = $6.1 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Tables VIII, IX and X.

* Design Criteria Only

Subzone 9-2 SRB Nose Cap--Stations 275-200 (General Specifications)

Same as Subzone 9-2-A below

Subzone 9-2-A Input to Components Mounted on the SRB Nose Cap--
Stations 275-200. Weight of Component < 10 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.75 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 1.50 g^2/Hz
60 - 73 Hz @ -6 dB/oct
73 - 250 Hz @ 1.00 g^2/Hz
250 - 600 Hz @ -9 dB/oct
600 - 1000 Hz @ 0.075 g^2/Hz
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0048 g^2/Hz

Composite = 20.0 g_{rms}

Long. and Tang. Axes

20 - 250 Hz @ 0.38 g^2/Hz
250 - 430 Hz @ -9 dB/oct
430 - 1000 Hz @ 0.075 g^2/Hz
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0048 g^2/Hz

Composite = 13.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.22 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 800 Hz @ 0.44 g^2/Hz
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 21.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.055 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 1100 Hz @ 0.11 g^2/Hz
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 12.3 g_{rms}

9-2-A (Cont.)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.15 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.30 g^2/Hz
 120 - 180 Hz @ +9 dB/oct
 180 - 800 Hz @ 1.00 g^2/Hz
 800 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.025 g^2/Hz

Composite = 30.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.038 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ 0.075 g^2/Hz
 120 - 180 Hz @ +9 dB/oct
 180 - 1100 Hz @ 0.25 g^2/Hz
 1100 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.023 g^2/Hz

Composite = 18.0 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 3.00 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 6.00 g^2/Hz
 60 - 73 Hz @ -6 dB/oct
 73 - 250 Hz @ 4.00 g^2/Hz
 250 - 600 Hz @ -9 dB/oct
 600 - 1000 Hz @ 0.30 g^2/Hz
 1000 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.019 g^2/Hz

Composite = 40.1 g_{rms}

Long. and Tang. Axes

20 - 250 Hz @ 1.50 g^2/Hz
 250 - 430 Hz @ -9 dB/oct
 430 - 1000 Hz @ 0.30 g^2/Hz
 1000 - 2000 Hz @ -12 dB/oct
 2000 Hz @ 0.019 g^2/Hz

Composite = 26.9 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
 5 - 10 Hz @ 0.7 G's peak
 10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
 5 - 10 Hz @ 0.5 G's peak
 10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Table VIII.

* Design Criteria Only

Subzone 9-2-B Input to Components Mounted on the SRB Nose Cap--
Stations 275-200. Weight of Component ≥ 10 but
 < 25 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ $0.75 \text{ g}^2/\text{Hz}$
 20 - 27 Hz @ +3 dB/oct
 27 - 50 Hz @ $1.00 \text{ g}^2/\text{Hz}$
 50 - 63 Hz @ -6 dB/oct.
 63 - 250 Hz @ $0.65 \text{ g}^2/\text{Hz}$
 250 - 600 Hz @ -9 dB/oct
 600 - 1000 Hz @ $0.050 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.0032 \text{ g}^2/\text{Hz}$

Composite = $16.2 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 250 Hz @ $0.25 \text{ g}^2/\text{Hz}$
 250 - 430 Hz @ -9 dB/oct
 430 - 1000 Hz @ $0.050 \text{ g}^2/\text{Hz}$
 1000 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.0032 \text{ g}^2/\text{Hz}$

Composite = $11.0 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.22 \text{ g}^2/\text{Hz}$
 20 - 28 Hz @ +3 dB/oct
 28 - 800 Hz @ $0.29 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.0075 \text{ g}^2/\text{Hz}$

Composite = $17.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.055 \text{ g}^2/\text{Hz}$
 20 - 28 Hz @ +3 dB/oct
 28 - 1100 Hz @ $0.075 \text{ g}^2/\text{Hz}$
 1100 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.0070 \text{ g}^2/\text{Hz}$

Composite = $10.2 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ $0.15 \text{ g}^2/\text{Hz}$
 20 - 27 Hz @ +3 dB/oct
 27 - 120 Hz @ $0.20 \text{ g}^2/\text{Hz}$
 120 - 180 Hz @ +9 dB/oct
 180 - 800 Hz @ $0.66 \text{ g}^2/\text{Hz}$
 800 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.017 \text{ g}^2/\text{Hz}$

Composite = $24.9 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.025 \text{ g}^2/\text{Hz}$
 20 - 40 Hz @ +3 dB/oct
 40 - 120 Hz @ $0.050 \text{ g}^2/\text{Hz}$
 120 - 180 Hz @ +9 dB/oct
 180 - 1100 Hz @ $0.17 \text{ g}^2/\text{Hz}$
 1100 - 2000 Hz @ -12 dB/oct
 2000 Hz @ $0.016 \text{ g}^2/\text{Hz}$

Composite = $14.8 \text{ g}_{\text{rms}}$

9-2-B (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 3.00 g^2/Hz
20 - 27 Hz @ +3 dB/oct
27 - 50 Hz @ 4.00 g^2/Hz
50 - 63 Hz @ -6 dB/oct
63 - 250 Hz @ 2.60 g^2/Hz
250 - 600 Hz @ -9 dB/oct
600 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.013 g^2/Hz

Composite = 32.5 g_{rms}

Long. and Tang. Axes

20 - 250 Hz @ 1.00 g^2/Hz
250 - 430 Hz @ -9 dB/oct
430 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.013 g^2/Hz

Composite = 22.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Table VIII.

* Design Criteria Only

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Subzone 9-2-C Input to Components Mounted on the SRB Nose Cap--
Stations 275-200. Weight of Component ≥ 25 lb.

1. Acceptance Test Criteria (1 min/axis)

Radial Axes	Long. and Tang. Axes
20 - 40 Hz @ $0.65 \text{ g}^2/\text{Hz}$	20 - 250 Hz @ $0.16 \text{ g}^2/\text{Hz}$
40 - 50 Hz @ -6 dB/oct	250 - 430 Hz @ -9 dB/oct
50 - 250 Hz @ $0.42 \text{ g}^2/\text{Hz}$	430 - 1000 Hz @ $0.032 \text{ g}^2/\text{Hz}$
250 - 600 Hz @ -9 dB/oct	1000 - 2000 Hz @ -12 dB/oct
600 - 1000 Hz @ $0.030 \text{ g}^2/\text{Hz}$	2000 Hz @ $0.0020 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -12 dB/oct	
2000 Hz @ $0.0019 \text{ g}^2/\text{Hz}$	
Composite = $12.9 \text{ g}_{\text{rms}}$	Composite = $8.7 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis	Long. and Tang. Axes
20 - 800 Hz @ $0.19 \text{ g}^2/\text{Hz}$	20 - 1100 Hz @ $0.048 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct	1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0050 \text{ g}^2/\text{Hz}$	2000 Hz @ $0.0050 \text{ g}^2/\text{Hz}$
Composite = $14.0 \text{ g}_{\text{rms}}$	Composite = $8.2 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis	Long. and Tang. Axes
20 - 120 Hz @ $0.13 \text{ g}^2/\text{Hz}$	20 Hz @ $0.016 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct	20 - 40 Hz @ +3 dB/oct
180 - 800 Hz @ $0.43 \text{ g}^2/\text{Hz}$	40 - 120 Hz @ $0.032 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct	120 - 180 Hz @ +9 dB/oct
2000 Hz @ $0.011 \text{ g}^2/\text{Hz}$	180 - 1100 Hz @ $0.11 \text{ g}^2/\text{Hz}$
	1100 - 2000 Hz @ -12 dB/oct
	2000 Hz @ $0.010 \text{ g}^2/\text{Hz}$
Composite = $20.1 \text{ g}_{\text{rms}}$	Composite = $11.9 \text{ g}_{\text{rms}}$

9-2-C (Cont.)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 40 Hz @ $2.60 \text{ g}^2/\text{Hz}$
40 - 50 Hz @ -6 dB/oct
50 - 250 Hz @ $1.70 \text{ g}^2/\text{Hz}$
250 - 600 Hz @ -9 dB/oct
600 - 1000 Hz @ $0.12 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0076 \text{ g}^2/\text{Hz}$

Composite = $25.9 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 250 Hz @ $0.63 \text{ g}^2/\text{Hz}$
250 - 430 Hz @ -9 dB/oct
430 - 1000 Hz @ $0.13 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0080 \text{ g}^2/\text{Hz}$

Composite = $17.5 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

See Table VIII.

* Design Criteria Only

Zone 10	Space Shuttle Main Engine
Subzone 10-1	Combustion Chamber Dome and Injector Area (General Specifications)
	Criteria A Page 305
Subzone 10-1-A	<u>Input to Main Combustion Chamber Igniter</u>
	Criteria A Page 305
Subzone 10-1-B	<u>Input to Main Oxidizer Valve</u>
	Criteria B Page 306
Subzone 10-1-C	<u>Input to Main Chamber Oxidizer Dome Purge Valve</u>
	Criteria R Page 324
Subzone 10-1-D	<u>Input to Customer Connect Stage End</u>
	Criteria C Page 308
Subzone 10-1-E	<u>Input to Pneumatic Shutdown Sequence Line</u> <u>Oxidizer Preburner Oxidizer Valve End</u>
	Criteria O Page 320
	<u>Main Oxidizer Valve End</u>
	Criteria B Page 306
	<u>Main Fuel Valve End</u>
	Criteria F Page 311
	<u>Fuel Preburner Oxidizer Valve End</u>
	Criteria J Page 315

Subzone 10-1-F Input to Fuel Bleed Duct

Main Fuel Valve End

Criteria F Page 311

Customer Connect End

Criteria C Page 308

Subzone 10-1-G Input to Hydraulic Supply Line and Hydraulic Return Line

Customer Connect End

Criteria C Page 308

Oxidizer Preburner Oxidizer Valve End

Criteria O Page 320

Main Fuel Valve End

Criteria F Page 311

Main Oxidizer Valve End

Criteria B Page 306

Chamber Coolant Valve End

Criteria F Page 311

Fuel Preburner Oxidizer Valve End

Criteria J Page 315

Subzone 10-1-H Input to Nitrogen Supply Line and Helium Supply Line

Pneumatic Package End

Criteria Q Page 323

Customer Connect End

Criteria C Page 308

Subzone 10-2 Combustion Chamber Throat (General Specifications)

Criteria D Page 309

Subzone 10-2-A Input to Engine Controller Assembly

Criteria D Page 309

**Subzone 10-3 Thrust Chamber Jacket Downstream of the Throat
(General Specifications)**

Criteria E Page 310

**Subzone 10-3-A Input to Main Fuel Valve, Fuel Bleed Valve,
Chamber Coolant Valve, and Fuel System Purge
Check Valve**

Criteria F Page 311

Subzone 10-3-B Input to Preburner Fuel Supply Duct

Main Fuel Valve End

Criteria F Page 311

Fuel Preburner End

Criteria H Page 313

Oxidizer Preburner End

Criteria L Page 317

Subzone 10-4 Fuel System (General Specifications)

Subzone 10-4-A Input to High Pressure Fuel Turbopump

Criteria G Page 312

**Subzone 10-4-B Input to Fuel Preburner Dome and Combustor, and
Fuel Preburner Igniter**

Criteria H Page 313

Subzone 10-4-C Input to Low-Pressure Fuel Turbopump

Criteria I Page 314

Subzone 10-4-D Input to Fuel Preburner Oxidizer Valve

Criteria J Page 315

Subzone 10-4-E Input to Oxidizer Bleed Valve

Criteria S Page 325

Subzone 10-4-F Input to Fuel Preburner Oxidizer Dome Purge Check Valve

Criteria T Page 326

Subzone 10-4-G Input to Low-Pressure Fuel Turbopump Discharge Duct

High Pressure Fuel Turbopump End

Criteria G Page 312

Low-Pressure Fuel Turbopump End

Criteria I Page 314

Subzone 10-4-H Input to Low-Pressure Fuel Turbopump Turbine Drive Duct

Low-Pressure Fuel Turbopump End

Criteria I Page 314

Combustion Chamber Dome End

Criteria A Page 305

Subzone 10-4-I Input to Low-Pressure Fuel Turbopump Turbine Discharge Duct and Hot Gas Manifold Coolant Duct

Low-Pressure Fuel Turbopump End

Criteria I Page 314

High-Pressure Oxidizer Turbopump End

Criteria K Page 316

High-Pressure Fuel Turbopump End

Criteria G Page 312

Subzone 10-4-J Input to Oxidizer Bleed Duct

Fuel Preburner Oxidizer Valve End

Criteria J Page 315

Customer Connect End

Criteria C Page 308

Subzone 10-4-K Input to Vehicle Fuel Tank Pressurization Duct

Low-Pressure Fuel Turbopump End

Criteria I Page 314

Customer Connect End

Criteria C Page 308

Subzone 10-4-L Input to Low-Pressure Fuel Turbopump Lift-off Control Line

Pneumatic Package End

Criteria Q Page 323

Low-Pressure Fuel Turbopump End

Criteria I Page 314

High-Pressure Fuel Turbopump End

Criteria G Page 312

Subzone 10-4-M Input to High-Pressure Fuel Duct

Main Fuel Valve End

Criteria F Page 311

High-Pressure Fuel Turbopump End

Criteria G Page 312

Subzone 10-4-N Input to Low Pressure Fuel Turbopump Discharge
Duct Long Flex Joint

Criteria W Page 330

Subzone 10-4-O Input to Low Pressure Fuel Turbopump Turbine
Discharge Duct Long Flex Joint

Criteria X Page 332

Subzone 10-4-P Input to Fuel Bleed Duct Flex Joints

Criteria Y Page 334

Subzone 10-5 Oxidizer System (General Specifications)

Subzone 10-5-A Input to High-Pressure Oxidizer Turbopump and Heat Exchanger

Criteria K Page 316

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Criteria L Page 317

Subzone 10-5-C Input to Low-Pressure Oxidizer Turbopump

Criteria M Page 318

Subzone 10-5-D Input to Antiflood Valve

Criteria N Page 319

Subzone 10-5-F Input to Oxidizer Preburner 'Oxidizer Valve

Criteria O Page 320

Subzone 10-5-F Input to Oxidizer Preburner Oxidizer Dome Purge
Check Valve

Criteria U Page 327

Subzone 10-5-G Input to Low-Pressure Oxidizer Turbopump Discharge Duct

High-Pressure Oxidizer Turbopump End

Criteria K Page 316

Low-Pressure Oxidizer Turbopump End

Criteria M Page 318

Subzone 10-5-H Input to Low-Pressure Oxidizer Turbopump Turbine Drive Duct

High-Pressure Oxidizer Turbopump End

Criteria K Page 316

Low-Pressure Oxidizer Turbopump End

Criteria M Page 318

Subzone 10-5-I Input to Vehicle Oxidizer Tank Pressurization Duct

High-Pressure Oxidizer Turbopump End

Criteria K Page 316

Customer Connect End

Criteria C Page 308

Subzone 10-5-J Input to Pneumatic Shutdown Control Line

Pneumatic Package End

Criteria Q Page 323

Oxidizer Preburner Oxidizer Valve End

Criteria O Page 320

Subzone 10-5-K Input to Preburner Oxidizer Supply Duct

High-Pressure Oxidizer Turbopump End

Criteria K Page 316

Fuel Preburner Oxidizer Valve End

Criteria J Page 315

Oxidizer Preburner Oxidizer Valve End

Criteria O Page 320

Subzone 10-5-L Input to High-Pressure Oxidizer Duct

Main Oxidizer Valve End

Criteria B Page 306

High-Pressure Oxidizer Turbopump End

Criteria K Page 316

Subzone 10-5-M Input to Heat Exchanger Oxidizer Supply Line

Antiflood Valve End

Criteria N Page 319

Heat Exchanger End

Criteria K Page 316

Subzone 10-5-N Input to Low Pressure Oxidizer Turbopump Discharge
Duct Long Flex Joint

Criteria V Page 328

Subzone 10-5-O Input to Oxidizer Tank Pressurant Duct Long Flex
Joint

Criteria Z Page 336

Subzone 10-6 Actuator Assembly (General Specifications)

Subzone 10-6-A Input to Actuator Assembly

Criteria P Page 322

Zone 10 Criteria

Criteria A Combustion Chamber Dome, Injector Area and Main
 Combustion Chamber Igniter

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.12 in. D. A. Disp.
- 44 - 990 Hz @ 12.0 G's peak
- 990 - 1400 Hz @ 0.00024 in. D. A. Disp.
- 1400 - 2000 Hz @ 24.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 250 Hz @ 0.21 g^2 /Hz
- 250 - 300 Hz @ +9 dB/oct
- 300 - 400 Hz @ 0.35 g^2 /Hz
- 400 - 515 Hz @ -6 dB/oct
- 515 - 2000 Hz @ 0.21 g^2 /Hz

Composite = 21.0 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria B

Main Oxidizer Valve (Sheet 1 of 2)

1. Transient Shock Spectra Criteria (120 pulses/axis with $Q = 10$)

X Axis

10 Hz @ 2.0 G's peak
 100 Hz @ 25.0 G's peak
 600 Hz @ 50.0 G's peak
 2000 Hz @ 150.0 G's peak

Y Axis

10 Hz @ 2.0 G's peak
 200 Hz @ 50.0 G's peak
 2000 Hz @ 90.0 G's peak

Z Axis

10 Hz @ 1.0 G's peak
 80 Hz @ 15.0 G's peak
 1000 Hz @ 20.0 G's peak
 2000 Hz @ 100.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

 X_v Axis

20 Hz @ 0.0080 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 Hz @ 0.020 g^2/Hz
 50 - 80 Hz @ +19 dB/oct
 80 - 110 Hz @ 0.40 g^2/Hz
 110 - 135 Hz @ -34 dB/oct
 135 - 170 Hz @ 0.040 g^2/Hz
 170 - 200 Hz @ +30 dB/oct
 200 - 530 Hz @ 0.20 g^2/Hz
 530 - 700 Hz @ -4 dB/oct
 700 - 2000 Hz @ 0.14 g^2/Hz

 Y_v Axis

20 Hz @ 0.0030 g^2/Hz
 20 - 50 Hz @ +3 dB/oct
 50 Hz @ 0.0070 g^2/Hz
 50 - 110 Hz @ +19 dB/oct
 110 - 170 Hz @ 0.17 g^2/Hz
 170 - 200 Hz @ +18 dB/oct
 200 - 400 Hz @ 0.44 g^2/Hz
 400 - 500 Hz @ -14 dB/oct
 500 - 700 Hz @ 0.15 g^2/Hz
 700 - 800 Hz @ +16 dB/oct
 800 - 950 Hz @ 0.30 g^2/Hz
 950 - 1200 Hz @ -14 dB/oct
 1200 - 2000 Hz @ 0.10 g^2/Hz

Swept Sinusoid (1 oct/min)

1200 - 2000 Hz @ 3.6 g_{rms} Composite = 17.4 g_{rms}

Swept Sinusoid (1 oct/min)

1200 - 2000 Hz @ 2.5 g_{rms} Composite = 18.9 g_{rms}

Criteria B Main Oxidizer Valve (Sheet 2 of 2) (Cont.)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

Z_v Axis

20 - 70 Hz @ 0.090 g²/Hz
70 - 90 Hz @ +10 dB/oct
90 - 110 Hz @ 0.21 g²/Hz
110 - 140 Hz @ -29 dB/oct
140 - 170 Hz @ 0.020 g²/Hz
170 - 300 Hz @ +13 dB/oct
300 - 530 Hz @ 0.24 g²/Hz
530 - 800 Hz @ -18 dB/oct
800 - 2000 Hz @ 0.022 g²/Hz

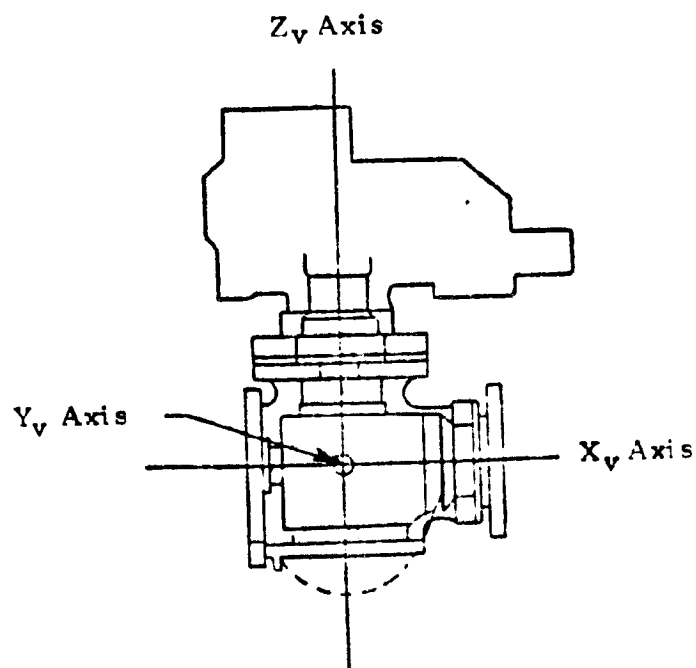
Swept Sinusoid (1 oct/min)

1200 - 2000 Hz @ 1.4 g_{rms}

Composite = 11.5 g_{rms}

3. Shock Test Criteria

No shock test required.



Criteria C

Customer Connect Stage End

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 13 Hz @ 0.38 in. D. A. Disp.
- 13 - 54 Hz @ 3.30 G's peak
- 54 - 140 Hz @ 0.022 in. D. A. Disp.
- 140 - 2000 Hz @ 22.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 70 Hz @ 0.012 g^2/Hz
- 70 - 100 Hz @ +18 dB/oct
- 100 - 318 Hz @ 0.12 g^2/Hz
- 318 - 400 Hz @ +12 dB/oct
- 400 - 2000 Hz @ 0.30 g^2/Hz

Composite = 22.9 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

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Criteria D

Combustion Chamber Throat and Engine Controller Assembly

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.12 in. D. A. Disp.
- 44 - 1140 Hz @ 12.0 G's peak
- 1140 - 1620 Hz @ 0.00018 in. D. A. Disp.
- 1620 - 2000 Hz @ 24.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1300 Hz @ 0.15 g^2/Hz
- 1300 - 1640 Hz @ +18 dB/oct
- 1640 - 2000 Hz @ 0.60 g^2/Hz

Composite = 22.8 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria E

Thrust Chamber Jacket Downstream of the Throat

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.12 in. D. A. Disp.
- 44 - 485 Hz @ 12.0 G's peak
- 485 - 990 Hz @ 0.0010 in. D. A. Disp.
- 990 - 2000 Hz @ 50.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 225 Hz @ 0.30 g^2/Hz
- 225 - 450 Hz @ +7 dB/oct
- 450 - 500 Hz @ 1.50 g^2/Hz
- 500 - 625 Hz @ -3 dB/oct
- 625 - 2000 Hz @ 1.20 g^2/Hz

Composite = 46.2 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria F

Main Fuel Valve, Fuel Bleed Valve, Chamber
Coolant Valve, and Fuel System Purge Check Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 49 Hz @ 0.12 in. D. A. Disp.
- 49 - 440 Hz @ 15.0 G's peak
- 440 - 685 Hz @ 0.0015 in. D. A. Disp.
- 685 - 2000 Hz @ 36.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 Hz @ 0.074 g^2/Hz
- 20 - 300 Hz @ +3 dB/oct
- 300 - 700 Hz @ 1.10 g^2/Hz
- 700 - 975 Hz @ -18 dB/oct
- 975 - 1300 Hz @ 0.15 g^2/Hz
- 1300 - 1450 Hz @ +48 dB/oct
- 1450 - 1550 Hz @ 0.85 g^2/Hz
- 1550 - 1790 Hz @ -36 dB/oct
- 1790 - 2000 Hz @ 0.15 g^2/Hz

Composite = 32.4 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria C High-Pressure Fuel Turbopump

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.11 in. D. A. Disp.
- 44 - 400 Hz @ 11.0 G's peak
- 400 - 705 Hz @ 0.0013 in. D. A. Disp.
- 705 - 2000 Hz @ 33.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 Hz @ 0.10 g^2/Hz
- 20 - 200 Hz @ +3 dB/oct
- 200 - 250 Hz @ 1.00 g^2/Hz
- 250 - 300 Hz @ -18 dB/oct
- 300 - 1245 Hz @ 0.35 g^2/Hz
- 1245 - 1400 Hz @ +24 dB/oct
- 1400 - 2000 Hz @ 0.90 g^2/Hz

Composite = 33.8 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria H

**Fuel Preburner Dome and Combustor, and Fuel
Preburner Igniter**

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 20 Hz @ 0.30 in. D. A. Disp.
- 20 - 140 Hz @ 6.0 G's peak
- 140 - 315 Hz @ 0.0060 in. D. A. Disp.
- 315 - 2000 Hz @ 30.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1200 Hz @ 0.17 g^2/Hz
- 1200 - 1400 Hz @ +48 dB/oct
- 1400 - 2000 Hz @ 2.00 g^2/Hz

Composite = 39.4 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria I Low-Pressure Fuel Turbopump

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 2 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.050 in. D A. Disp.
- 44 - 400 Hz @ 5.0 G's peak
- 400 - 800 Hz @ 0.00060 in. D. A. Disp.
- 800 - 2000 Hz @ 20.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 500 Hz @ 0.30 g^2 /Hz
- 500 - 600 Hz @ -18 dB/oct
- 600 - 1060 Hz @ 0.10 g^2 /Hz
- 1060 - 1400 Hz @ +21 dB/oct
- 1400 - 2000 Hz @ 0.70 g^2 /Hz

Composite = 27.1 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

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Criteria J

Fuel Preburner Oxidizer Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.25 in. D. A. Disp.
- 44 - 70 Hz @ 25.0 G's peak
- 70 - 200 Hz @ 11.0 G's peak
- 200 - 300 Hz @ 45.0 G's peak
- 300 - 400 Hz @ 100.0 G's peak
- 400 - 1700 Hz @ 30.0 G's peak
- 1700 - 2000 Hz @ 45.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 Hz @ 0.20 g^2/Hz
- 20 - 42 Hz @ +12 dB/oct
- 42 - 75 Hz @ 4.00 g^2/Hz
- 75 - 100 Hz @ -27 dB/oct
- 100 - 215 Hz @ 0.30 g^2/Hz
- 215 - 312 Hz @ +21 dB/oct
- 312 - 400 Hz @ 4.00 g^2/Hz
- 400 - 580 Hz @ -21 dB/oct
- 580 - 1200 Hz @ 0.30 g^2/Hz
- 1200 - 1490 Hz @ +36 dB/oct
- 1490 - 2000 Hz @ 4.00 g^2/Hz

Composite = 60.2 g_{rms}

3. Shock Criteria

No shock test required

* Design Criteria Only

Criteria K High-Pressure Oxidizer Turbopump and Heat
Exchanger

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.11 in. D. A. Disp.
- 44 - 700 Hz @ 11.0 G's peak
- 700 - 1490 Hz @ 0.00044 in. D. A. Disp.
- 1490 - 2000 Hz @ 50.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1200 Hz 0.15 g^2/Hz
- 1200 - 1760 Hz @ +18 dB/oct
- 1760 - 2000 Hz @ 1.50 g^2/Hz

Superimposed Sinusoids (6.5 hr/axis)

- 520 Hz @ 4.0 g_{rms}
- 2000 Hz @ 15.5 g_{rms}

Swept Sinusoids (60 Sweeps, 1 min/sweep)

- 520 - 350 Hz @ 4.0 g_{rms}
- 2000 - 1390 Hz @ 15.5 g_{rms}

$$\text{Composite} = 33.8 g_{rms}$$

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria L

Oxidizer Preburner Dome and Combustor, and
Oxidizer Preburner Igniter

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 20 Hz @ 0.39 in. D. A. Disp.
- 20 - 140 Hz @ 8.0 G's peak
- 140 - 315 Hz @ 0.0080 in. D. A. Disp.
- 315 - 2000 Hz @ 40.0 G's peak

2. Random Vibration Criteria (7.5 nr/axis)

- 20 - 1200 Hz @ 0.30 g^2/Hz
- 1200 - 1400 Hz @ +48 dB/oct
- 1400 - 2000 Hz @ 3.50 g^2/Hz

Composite = 52.2 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria M

Low-Pressure Oxidizer Turbopump

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 56 Hz @ 0.050 in. D. A. Disp.
- 56 - 880 Hz @ 8.0 G's peak
- 880 - 1565 Hz @ 0.00020 in. D. A. Disp.
- 1565 - 2000 Hz @ 25.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1200 Hz @ 0.12 g^2/Hz
- 1200 - 1760 Hz @ +18 dB/oct
- 1760 - 2000 Hz @ 1.20 g^2/Hz

Superimposed Sinusoid (6.5 hr/axis)

90 Hz @ 4.0 g_{rms}

Swept Sinusoid (60 Sweeps, 1 min/sweep)

90 - 70 Hz @ 4.0 g_{rms}

Composite = 27.0 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria N

Antiflood Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 80 Hz @ 0.20 in. D. A. Disp.
- 80 - 170 Hz @ 65.0 G's peak
- 170 - 600 Hz @ 35.0 G's peak
- 600 - 1180 Hz @ 25.0 G's peak
- 1180 - 1500 Hz @ 0.00035 in. D. A. Disp.
- 1500 - 2000 Hz @ 40.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 40 Hz @ 0.25 g^2/Hz
- 40 - 71 Hz @ +18 dB/oct
- 71 - 300 Hz @ 8.00 g^2/Hz
- 300 - 425 Hz @ -12 dB/oct
- 425 - 625 Hz @ 2.00 g^2/Hz
- 625 - 745 Hz @ -30 dB/oct
- 745 - 1200 Hz @ 0.35 g^2/Hz
- 1200 - 1450 Hz @ +18 dB/oct
- 1450 - 2000 Hz @ 1.10 g^2/Hz

Composite = 62.3 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria O

Oxidizer Preburner Oxidizer Valve (Sheet 1 of 2)

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.28 in. D. A. Disp.
- 44 - 65 Hz @ 28.0 G's peak
- 65 - 200 Hz @ 12.0 G's peak
- 200 - 330 Hz @ 40.0 G's peak
- 330 - 430 Hz @ 73.0 G's peak
- 430 - 850 Hz @ 25.0 G's peak
- 850 - 1400 Hz @ 0.00068 in. D. A. Disp.
- 1400 - 2000 Hz @ 68.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

X_v Axis

- 20 Hz @ 0.20 g²/Hz
- 20 - 45 Hz @ +6 dB/oct
- 45 - 100 Hz @ 1.00 g²/Hz
- 100 - 145 Hz @ +9 dB/oct
- 145 - 240 Hz @ 3.00 g²/Hz
- 240 - 305 Hz @ -27 dB/oct
- 305 - 495 Hz @ 0.35 g²/Hz
- 495 - 600 Hz @ -30 dB/oct
- 600 - 1230 Hz @ 0.050 g²/Hz
- 1230 - 1415 Hz @ +60 dB/oct
- 1415 - 2000 Hz @ 0.90 g²/Hz

Composite = 33.9 g_{rms}

Y_v Axis

- 20 Hz @ 0.25 g²/Hz
- 20 - 40 Hz @ +9 dB/oct
- 40 - 175 Hz @ 2.00 g²/Hz
- 175 - 350 Hz @ -4 dB/oct
- 350 - 475 Hz @ 0.80 g²/Hz
- 475 - 645 Hz @ -27 dB/oct
- 645 - 1220 Hz @ 0.050 g²/Hz
- 1220 - 1420 Hz @ +63 dB/oct
- 1420 - 2000 Hz @ 1.20 g²/Hz

Composite = 38.0 g_{rms}

* Design Criteria Only

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Criteria O

Oxidizer Preburner Oxidizer Valve (Sheet 2 of 2)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

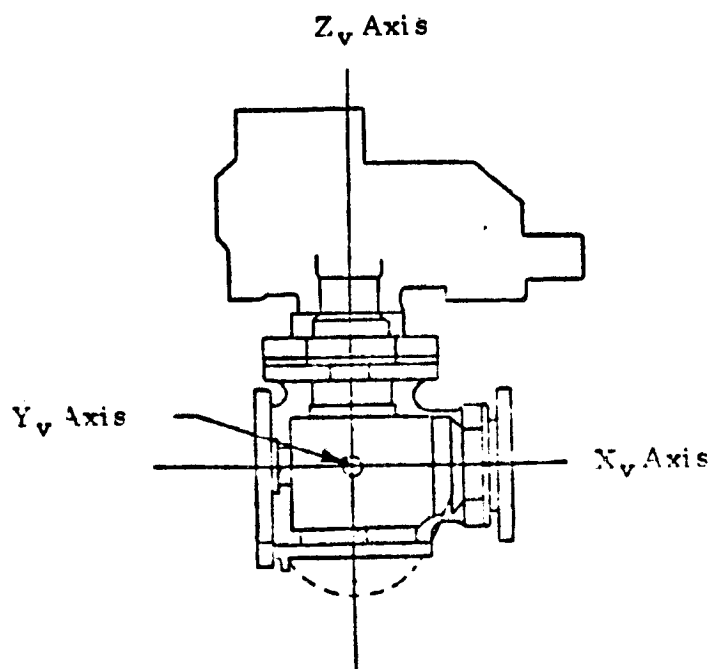
Z_v Axis

	20 Hz @ 0.37 g^2/Hz
20 -	35 Hz @ +12 dB/oct
35 -	65 Hz @ 3.50 g^2/Hz
65 -	90 Hz @ -15 dB/oct
90 -	125 Hz @ 0.65 g^2/Hz
125 -	155 Hz @ +21 dB/oct
155 -	265 Hz @ 3.00 g^2/Hz
265 -	900 Hz @ -30 dB/oct
900 -	1195 Hz @ 0.050 g^2/Hz
1195 -	1400 Hz @ +42 dB/oct
1400 -	1615 Hz @ 0.45 g^2/Hz
1615 -	2000 Hz @ -21 dB/oct
	2000 Hz @ 0.10 g^2/Hz

Composite = 30.3 g_{rms}

3. Shock Criteria

No shock test required.



Criteria P

Actuator Assembly

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 28 Hz @ 0.30 in. D. A. Disp.
- 28 - 260 Hz @ 12.0 G's peak
- 260 - 350 Hz @ 0.0035 in. D. A. Disp.
- 350 - 2000 Hz @ 22.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

20 - 2000 Hz @ 0.40 g^2/Hz

Composite = 28.1 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria Q

Pneumatic Package

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.11 in. D. A. Disp.
- 44 - 700 Hz @ 11.0 G's peak
- 700 - 1490 Hz @ 0.00044 in. D. A. Disp.
- 1490 - 2000 Hz @ 50.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1200 Hz @ 0.15 g^2/Hz
- 1200 - 1760 Hz @ +18 dB/oct
- 1760 - 2000 Hz @ 1.50 g^2/Hz

Composite = 29.8 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria R

Main Chamber Oxidizer Dome Purge Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 44 Hz @ 0.12 in. D. A. Disp.
- 44 - 580 Hz @ 12.0 G's peak
- 580 - 1000 Hz @ 0.00070 in. D. A. Disp.
- 1000 - 2000 Hz @ 36.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 170 Hz @ 0.17 g^2/Hz
- 170 - 245 Hz @ +6 dB/oct
- 245 - 525 Hz @ 0.35 g^2/Hz
- 525 - 750 Hz @ -6 dB/oct
- 750 - 1400 Hz @ 0.17 g^2/Hz
- 1400 - 1520 Hz @ +21 dB/oct
- 1520 - 2000 Hz @ 0.30 g^2/Hz

Superimposed Sinusoid (6.5 hr/axis)

1980 Hz @ 6.0 g_{rms}

Swept Sinusoid (60 Sweeps, 1 min/sweep)

1980 - 1320 Hz @ 6.0 g_{rms}

Composite = 22.0 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria S

Oxidizer Bleed Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 34 Hz @ 0.46 in. D. A. Disp.
- 34 - 85 Hz @ 27.0 G's peak
- 85 - 210 Hz @ 10.0 G's peak
- 210 - 270 Hz @ 30.0 G's peak
- 270 - 370 Hz @ 78.0 G's peak
- 370 - 530 Hz @ 34.0 G's peak
- 530 - 2000 Hz @ 22.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 Hz @ 0.23 g^2/Hz
- 20 - 40 Hz @ +12 dB/oct
- 40 - 80 Hz @ 3.50 g^2/Hz
- 80 - 125 Hz @ -12 dB/oct
- 125 - 225 Hz @ 0.60 g^2/Hz
- 225 - 292 Hz @ +15 dB/oct
- 292 - 429 Hz @ 2.20 g^2/Hz
- 429 - 620 Hz @ -15 dB/oct
- 620 - 1200 Hz @ 0.35 g^2/Hz
- 1200 - 1450 Hz @ +21 dB/oct
- 1450 - 2000 Hz @ 1.70 g^2/Hz

Composite = 44.4 g_{rms}

3. Shock Criteria

No shock Test Required

* Design Criteria Only

Criteria T

Fuel Preburner Oxidizer Dome Purge Check Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 20 Hz @ 0.30 in. D. A. Disp.
- 20 - 140 Hz @ 6.0 G's peak
- 140 - 315 Hz @ 0.0060 in. D. A. Disp.
- 315 - 2000 Hz @ 30.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1200 Hz @ 0.17 g^2/Hz
- 1200 - 1400 Hz @ +48 dB/oct
- 1400 - 2000 Hz @ 2.00 g^2/Hz

Superimposed Sinusoid (6.5 hr/axis)

1980 Hz @ 15.5 g_{rms}

Swept Sinusoid (60 Sweeps, 1 min/sweep)

1980 - 1320 Hz @ 15.5 g_{rms}

Composite = 39.6 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria U

Oxidizer Preburner Oxidizer Dome Purge Check
Valve

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 20 Hz @ 0.39 in. D. A. Disp.
- 20 - 140 Hz @ 8.0 G's peak
- 140 - 315 Hz @ 0.0080 in. D. A. Disp.
- 315 - 2000 Hz @ 40.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

- 20 - 1200 Hz @ 0.30 g^2/Hz
- 1200 - 1400 Hz @ +48 dB/oct
- 1400 - 2000 Hz @ 3.50 g^2/Hz

Superimposed Sinusoid (6.5 hr/axis)

1980 Hz @ 15.5 g_{rms}

Swept Sinusoid (60 Sweeps, 1 min/sweep)

1980 - 1320 Hz @ 15.5 g_{rms}

Composite = 54.4 g_{rms}

3. Shock Criteria

No shock test required.

* Design Criteria Only

Criteria V

Low Pressure Oxidizer Turbopump Discharge Duct
Long Flex Joint (Sheet 1 of 2)

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

Axial (Parallel to Flow)

3 - 10 Hz @ 2.0 G's peak*
10 - 20 Hz @ 0.50 in. D. A. Disp.
20 - 2000 Hz @ 10.0 G's peak

Radial (Perpendicular to Flow)

3 - 10 Hz @ 2.0 G's peak*
10 - 40 Hz @ 0.50 in. D. A. Disp.
40 - 100 Hz @ 40.0 G's peak
100 - 350 Hz @ 20.0 G's peak
350 - 2000 Hz @ 12.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

Axial (Parallel to Flow)

20 - 65 Hz @ 0.30 g^2 /Hz
65 - 250 Hz @ +4 dB/oct
250 - 350 Hz @ 1.80 g^2 /Hz
350 - 490 Hz @ -24 dB/oct
490 - 690 Hz @ 0.12 g^2 /Hz
690 - 750 Hz @ +22 dB/oct
750 - 800 Hz @ 0.22 g^2 /Hz
800 - 905 Hz @ -15 dB/oct
905 - 1105 Hz @ 0.12 g^2 /Hz
1105 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.037 g^2 /Hz

Superimposed Sinusoids (7.5 hr/axis)

20 Hz @ 4.0 g_{rms}
46 Hz @ 3.0 g_{rms}

Composite = 25.1 g_{rms}

* Design Criteria Only

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Criteria V

Low Pressure Oxidizer Turbopump Discharge Duct
Long Flex Joint (Sheet 2 of 2)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

Radial (Perpendicular to Flow)

20 - 345 Hz @ $0.30 \text{ g}^2/\text{Hz}$
345 - 500 Hz @ +9 dB/oct
500 - 785 Hz @ $0.90 \text{ g}^2/\text{Hz}$
785 - 1100 Hz @ -18 dB/oct
1100 - 1200 Hz @ $0.12 \text{ g}^2/\text{Hz}$
1200 - 1300 Hz @ +60 dB/oct
1300 - 1350 Hz @ $0.60 \text{ g}^2/\text{Hz}$
1350 - 2000 Hz @ -18 dB/oct
2000 Hz @ $0.057 \text{ g}^2/\text{Hz}$

Swept Sinusoids (20 - 320 - 20 Hz @ 1/2 oct/min)

20 - 42 Hz @ 0.16 in. D. A. Disp.
42 - 248 Hz @ $10.0 \text{ g}_{\text{rms}}$
248 - 300 Hz @ 0.0045 in. D. A. Disp. ———
300 - 320 Hz @ $14.5 \text{ g}_{\text{rms}}$

Composite = 27.9 - 31.3 g_{rms}

3. Shock Criteria

No shock test required.

Criteria W

Low Pressure Fuel Turbopump Discharge Duct Long
Flex Joint (Sheet 1 of 2)

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

Axial (Parallel to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 11 Hz @ 0.50 in. D. A. Disp.
- 11 - 26 Hz @ 3.0 G's peak
- 26 - 39 Hz @ 0.090 in. D. A. Disp.
- 39 - 2000 Hz @ 7.0 G's peak

Radial (Perpendicular to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 40 Hz @ 0.50 in. D. A. Disp.
- 40 - 50 Hz @ 40.0 G's peak
- 50 - 445 Hz @ 11.0 G's peak
- 445 - 705 Hz @ 0.0011 in. D. A. Disp.
- 705 - 1200 Hz @ 28.0 G's peak
- 1200 - 2000 Hz @ 6.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

Axial (Parallel to Flow)

- 20 Hz @ 0.034 g^2/Hz
- 20 - 40 Hz @ +12 dB/oct
- 40 - 75 Hz @ 0.55 g^2/Hz
- 75 - 115 Hz @ -12 dB/oct
- 115 - 165 Hz @ 0.10 g^2/Hz
- 165 - 210 Hz @ +26 dB/oct
- 210 - 260 Hz @ 0.80 g^2/Hz
- 260 - 310 Hz @ -42 dB/oct
- 310 - 500 Hz @ 0.070 g^2/Hz
- 500 - 600 Hz @ -21 dB/oct
- 600 - 1500 Hz @ 0.020 g^2/Hz
- 1500 - 1750 Hz @ +18 dB/oct
- 1750 - 2000 Hz @ 0.050 g^2/Hz

Composite = 12.8 g_{rms}

* Design Criteria Only

Criteria W

Low Pressure Fuel Turbopump Discharge Duct Long
Flex Joint (Sheet 2 of 2)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

Radial (Perpendicular to Flow)

	20 Hz @ 0.20 g^2/Hz
20 -	30 Hz @ +10 dB/oct
30 -	60 Hz @ 0.75 g^2/Hz
60 -	85 Hz @ +10 dB/oct
85 -	260 Hz @ 2.50 g^2/Hz
260 -	310 Hz @ -36 dB/oct
310 -	600 Hz @ 0.30 g^2/Hz
600 -	700 Hz @ +20 dB/oct
700 -	1000 Hz @ 0.85 g^2/Hz
1000 -	1215 Hz @ -30 dB/oct
1215 -	2000 Hz @ 0.12 g^2/Hz

Superimposed Sinusoid (7.5 hr/axis)

40 Hz @ 10.0 g_{rms}

Composite = 34.9 g_{rms}

3. Shock Criteria

No shock test required.

Criteria X

Low Pressure Fuel Turbopump Turbine Discharge
Duct Long Flex Joint (Sheet 1 of 2)

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

Axial (Parallel to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 27 Hz @ 0.45 in. D. A. Disp.
- 27 - 100 Hz @ 17.0 G's peak
- 100 - 350 Hz @ 10.0 G's peak
- 350 - 2000 Hz @ 5.0 G's peak

Radial (Perpendicular to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 40 Hz @ 0.40 in. D. A. Disp.
- 40 - 350 Hz @ 32.0 G's peak
- 350 - 1100 Hz @ 20.0 G's peak
- 1100 - 2000 Hz @ 7.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

Axial (Parallel to Flow)

- 20 - 95 Hz @ 0.30 g^2/Hz
- 95 - 120 Hz @ +12 dB/oct
- 120 - 150 Hz @ 0.75 g^2/Hz
- 150 - 185 Hz @ -9 dB/oct
- 185 - 300 Hz @ 0.40 g^2/Hz
- 300 - 900 Hz @ -12 dB/oct
- 900 - 1200 Hz @ 0.0050 g^2/Hz
- 1200 - 1510 Hz @ +30 dB/oct
- 1510 - 2000 Hz @ 0.050 g^2/Hz

Superimposed Sinusoids (7.5 hr/axis)

- 41 Hz @ 3.5 g_{rms}
- 73 Hz @ 6.0 g_{rms}

Composite = 15.5 g_{rms}

* Design Criteria Only

Criteria X

Low Pressure Fuel Turbopump Turbine Discharge
Duct Long Flex Joint (Sheet 2 of 2)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

Radial (Perpendicular to Flow)

20 - 200 Hz @ $0.30 \text{ g}^2/\text{Hz}$
200 - 255 Hz @ +15 dB/oct
255 - 355 Hz @ $1.00 \text{ g}^2/\text{Hz}$
355 - 500 Hz @ -6 dB/oct
500 - 1000 Hz @ $0.50 \text{ g}^2/\text{Hz}$
1000 - 1075 Hz @ -60 dB/oct
1075 - 1275 Hz @ $0.12 \text{ g}^2/\text{Hz}$
1275 - 1370 Hz @ +30 dB/oct
1370 - 1625 Hz @ $0.25 \text{ g}^2/\text{Hz}$
1625 - 2000 Hz @ -48 dB/oct
2000 Hz @ $0.0090 \text{ g}^2/\text{Hz}$

Swept Sinusoids (40 - 160 - 40 Hz @ 1/2 oct/min)*

40 - 63 Hz @ 0.081 in. D. A. Disp.
63 - 160 Hz @ $11.5 \text{ g}_{\text{rms}}$

Composite = $26.7 - 28.7 \text{ g}_{\text{rms}}$

3. Shock Criteria

No shock test required.

Criteria Y

Fuel Bleed Duct Flex Joints (Sheet 1 of 2)

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

Axial (Parallel to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 25 Hz @ 0.80 in. D. A. Disp.
- 25 - 200 Hz @ 25.0 G's peak
- 200 - 500 Hz @ 10.0 G's peak
- 500 - 2000 Hz @ 4.0 G's peak

Radial (Perpendicular to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 28 Hz @ 1.00 in. D. A. Disp.
- 28 - 40 Hz @ 40.0 G's peak
- 40 - 60 Hz @ 70.0 G's peak
- 60 - 240 Hz @ 24.0 G's peak
- 240 - 900 Hz @ 14.0 G's peak
- 900 - 2000 Hz @ 27.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

Axial (Parallel to Flow)

- 20 - 70 Hz @ 1.00 g^2/Hz
- 70 - 80 Hz @ +4 dB/oct
- 80 - 200 Hz @ 1.20 g^2/Hz
- 200 - 300 Hz @ -4 dB/oct
- 300 Hz @ 0.70 g^2/Hz
- 300 - 500 Hz @ -21 dB/oct
- 500 - 780 Hz @ 0.020 g^2/Hz
- 780 - 1100 Hz @ -6 dB/oct
- 1100 - 2000 Hz @ 0.010 g^2/Hz

Superimposed Sinusoid (7.5 hr/axis)

48 Hz @ 2.2 g_{rms}

Swept Sinusoid (20 - 28 - 20 Hz @ 1/2 oct/min)

20 - 28 Hz @ 1.3 g_{rms}

Composite = 18.8 g_{rms}

* Design Criteria Only

Criteria Y Fuel Bleed Duct Flex Joints (Sheet 2 of 2)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

Radial (Perpendicular to Flow)

20 - 80 Hz @ 1.30 g^2 /Hz
80 - 120 Hz @ +6 dB/oct
120 - 150 Hz @ 3.00 g^2 /Hz
150 - 180 Hz @ +11 dB/oct
180 - 230 Hz @ 6.00 g^2 /Hz
230 - 270 Hz @ -29 dB/oct
270 - 380 Hz @ 1.30 g^2 /Hz
380 - 450 Hz @ -33 dB/oct
450 - 700 Hz @ 0.20 g^2 /Hz
700 - 1000 Hz @ +17 dB/oct
1000 - 1150 Hz @ 1.50 g^2 /Hz
1150 - 1250 Hz @ -48 dB/oct
1250 - 1500 Hz @ 0.40 g^2 /Hz
1500 - 1650 Hz @ +55 dB/oct
1650 - 1750 Hz @ 2.30 g^2 /Hz
1750 - 2000 Hz @ -39 dB/oct
2000 Hz @ 0.40 g^2 /Hz

Superimposed Sinusoid (7.5 hr/axis)

27 Hz @ 7.6 g_{rms}

Swept Sinusoid (45 - 65 - 45 Hz @ 1/2 oct/min)

45 - 65 Hz @ 6.4 g_{rms}

Composite = 49.1 g_{rms}

3. Shock Criteria

No shock test required.

Criteria Z

Oxidizer Tank Pressurant Duct Long Flex Joint
(Sheet 1 of 2)

1. Sinusoidal Sweep Criteria (4 Sweeps, 3 - 2000 - 3 Hz @ 1 oct/min)

Axial (Parallel to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 30 Hz @ 0.90 in. D. A. Disp.
- 30 - 45 Hz @ 40.0 G's peak
- 45 - 100 Hz @ 20.0 G's peak
- 100 - 500 Hz @ 10.0 G's peak
- 500 - 2000 Hz @ 3.0 G's peak

Radial (Perpendicular to Flow)

- 3 - 10 Hz @ 2.0 G's peak*
- 10 - 30 Hz @ 0.90 in. D. A. Disp.
- 30 - 55 Hz @ 40.0 G's peak
- 55 - 80 Hz @ 25.0 G's peak
- 80 - 1100 Hz @ 17.0 G's peak
- 1100 - 2000 Hz @ 35.0 G's peak

2. Random Vibration Criteria (7.5 hr/axis)

Axial (Parallel to Flow)

- 20 - 50 Hz @ 0.70 g^2/Hz
- 50 - 60 Hz @ +13 dB/oct
- 60 - 90 Hz @ 1.50 g^2/Hz
- 90 - 100 Hz @ -38 dB/oct
- 100 - 400 Hz @ 0.40 g^2/Hz
- 400 - 600 Hz @ -27 dB/oct
- 600 - 2000 Hz @ 0.010 g^2/Hz

Superimposed Sinusoid (7.5 hr/axis)

35 Hz @ 9.3 g_{rms}

Composite = 18.0 g_{rms}

* Design Criteria Only

Criteria Z

Oxidizer Tank Pressurant Duct Long Flex Joint
(Sheet 2 of 2)

2. Random Vibration Criteria (7.5 hr/axis) (Cont.)

Radial (Perpendicular to Flow)

20 - 72 Hz @ 1.30 g^2/Hz
72 - 90 Hz @ -20 dB/oct
90 - 200 Hz @ 0.30 g^2/Hz
200 - 250 Hz @ +21 dB/oct
250 - 300 Hz @ 1.40 g^2/Hz
300 - 350 Hz @ -16 dB/oct
350 - 600 Hz @ 0.60 g^2/Hz
600 - 700 Hz @ +10 dB/oct
700 - 800 Hz @ 1.00 g^2/Hz
800 - 900 Hz @ -31 dB/oct
900 - 1200 Hz @ 0.30 g^2/Hz
1200 - 1400 Hz @ +34 dB/oct
1400 - 1550 Hz @ 1.70 g^2/Hz
1550 - 1650 Hz @ -26 dB/oct
1650 - 2000 Hz @ 1.00 g^2/Hz

Superimposed Sinusoid (7.5 hr/axis)

24 Hz @ 1.2 g_{rms}

Swept Sinusoid (30 - 55 - 30 Hz @ 1/2 oct/min)

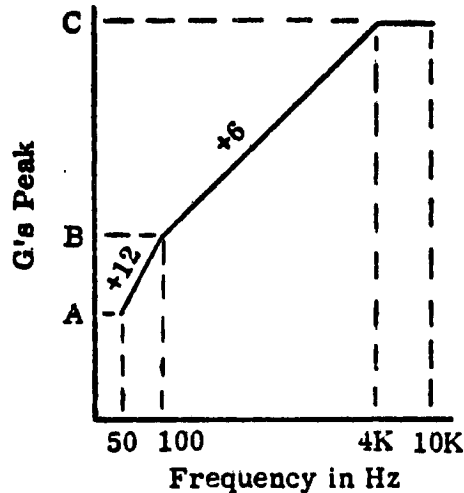
30 - 55 Hz @ 9.7 g_{rms}

Composite = 41.7 g_{rms}

3. Shock Criteria

No shock test required.

PYROTECHNIC SHOCK SPECTRUM CRITERIA
FOR COMPONENTS MOUNTED TO SPACE SHUTTLE STRUCTURE



SHOCK SPECTRUM

50 Hz @ A G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ B G's peak
100 - 4000 Hz @ +6 dB/oct
4000 - 10000 Hz @ C G's peak

Note: For proper spectrum, use most severe of applicable levels from tables below.

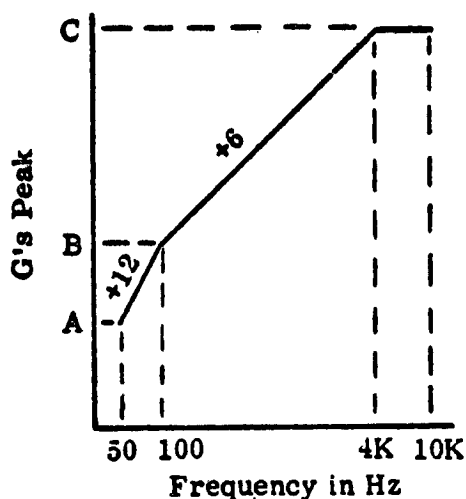
TABLE I. EXTERNAL TANK

Shock Source	D = Distance from component to ET/SRB Fwd Attach Point (in.)	Spectrum Amplitudes		
		A	B	C
Fwd Attach Bolts	0 < D ≤ 12	94	375	15,000
	12 < D ≤ 24	47	188	7,500
	24 < D ≤ 48	24	94	3,750
	48 < D ≤ 96	12	47	1,875
	96 < D	N/A	N/A	N/A
Aft Attach Bolts	d = Distance from component to ET/SRB Aft Attach Point (in.)			
	0 < d ≤ 12	24	94	3,750
	12 < d ≤ 24	12	47	1,875
	24 < d	N/A	N/A	N/A

TABLE II. SRB NOZZLE

Shock Source	SRB Station Number (X _b) of Component (in.)	Spectrum Amplitudes		
		A	B	C
Nozzle Severance	1989.6 ≥ X _b > 1970.6	235	938	37,500
	1970.6 ≥ X _b > 1947.2	469	1,875	75,000
	1947.2 ≥ X _b > 1935.5	938	3,750	150,000
	1935.5 ≥ X _b > 1912.3	1,875	7,500	300,000
	1912.3 > X _b > 1901.3	938	3,750	150,000
	1901.3 > X _b > 1884.7	469	1,875	75,000
	1884.7 > X _b > 1879.0	332	1,325	53,000
	1879.0 > X _b > 1833.8	166	662	26,500

PYROTECHNIC SHOCK SPECTRUM CRITERIA
FOR COMPONENTS MOUNTED TO SPACE SHUTTLE STRUCTURE



SHOCK SPECTRUM

50 Hz @ A G's peak
 50 - 100 Hz @ +12 dB/oct
 100 Hz @ B G's peak
 100 - 4000 Hz @ +6 dB/oct
 4000 - 10000 Hz @ C G's peak

Note: For proper spectrum, use most severe of applicable levels from tables below.

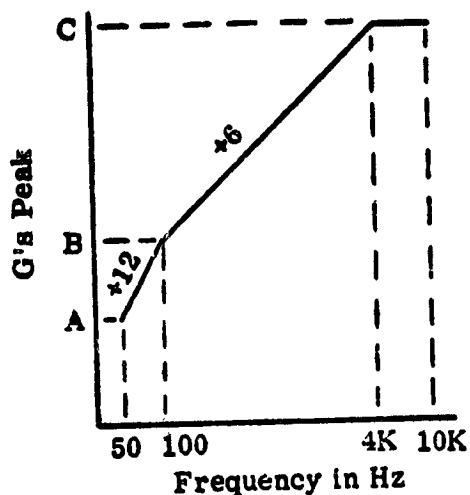
TABLE III. SRB AFT SKIRT

Shock Source	D = Distance from Component to Actuator/Aft Skirt Attach Point (in.)	Spectrum Amplitudes		
		A	B	C
Nozzle Severance	$0 < D \leq 36$	30	117	4,688
	$36 < D \leq 132$	15	59	2,344
	$132 < D \leq 324$	8	29	1,172
	$324 < D$	N/A	N/A	N/A
SRB Release At Lift-off (Hold-Down)	D = Distance from Component to SRB Hold-down Point (in.)			
	$0 < D \leq 12$	94	375	15,000
	$12 < D \leq 24$	47	188	7,500
	$24 < D \leq 48$	24	94	3,750
	$48 < D \leq 96$	12	47	1,875
	$96 < D$	N/A	N/A	N/A

TABLE IV. SRB FUEL CYLINDER AND BULKHEADS

Shock Source	SRB Station Number (X_b) of Component (in.)	Spectrum Amplitudes		
		A	B	C
Nozzle Severance	$1875 > X_b \geq 1733$	8	29	1,172
	$1733 > X_b \geq 486.3$	N/A	N/A	N/A
Aft Attach Bolts	D = Distance from Component to ET/SRB Aft Attach Point (in.)			
	$0 < D \leq 33$	24	94	3,750
	$33 < D \leq 81$	12	47	1,875
	$81 < D$	N/A	N/A	N/A

PYROTECHNIC SHOCK SPECTRUM CRITERIA
FOR COMPONENTS MOUNTED TO SPACE SHUTTLE STRUCTURE



SHOCK SPECTRUM

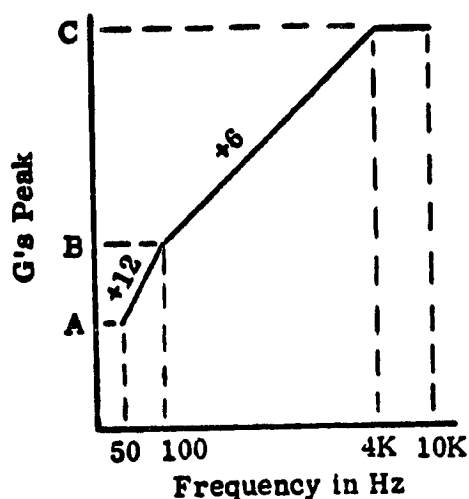
50 Hz @ A G's peak
 50 - 100 Hz @ +12 dB/oct
 100 Hz @ B G's peak
 100 - 4000 Hz @ +6 dB/oct
 4000 - 10000 Hz @ C G's peak

Note: For proper spectrum, use most severe of applicable levels from tables below.

TABLE V. SRB FORWARD SKIRT

Shock Source	SRB Station Number (X_b) of Component (in.)	Spectrum Amplitudes		
		A	B	C
Fwd Skirt/ Frustum Separation	395 < X_b ≤ 407	188	750	30,000
	407 < X_b ≤ 419	94	375	15,000
	419 < X_b ≤ 443	47	188	7,500
	443 < X_b ≤ 491	24	94	3,750
	491 < X_b ≤ 530.5	12	47	1,875
	530.5 < X_b	N/A	N/A	N/A
Fwd Attach Bolt	D = Distance from Component to ET/SRB Fwd Attach Point (in.)			
	0 < D ≤ 12	94	375	15,000
	12 < D ≤ 24	47	188	7,500
	24 < D ≤ 48	24	94	3,750
	48 < D ≤ 96	12	47	1,875
	96 < D	N/A	N/A	N/A

PYROTECHNIC SHOCK SPECTRUM CRITERIA
FOR COMPONENTS MOUNTED TO SPACE SHUTTLE STRUCTURE



SHOCK SPECTRUM

50 Hz @ A G's peak
 50 - 100 Hz @ +12 dB/oct
 100 Hz @ B G's peak
 100 - 4000 Hz @ +6 dB/oct
 4000 - 10000 Hz @ C G's peak

Note: For proper spectrum, use most severe of applicable levels from tables below.

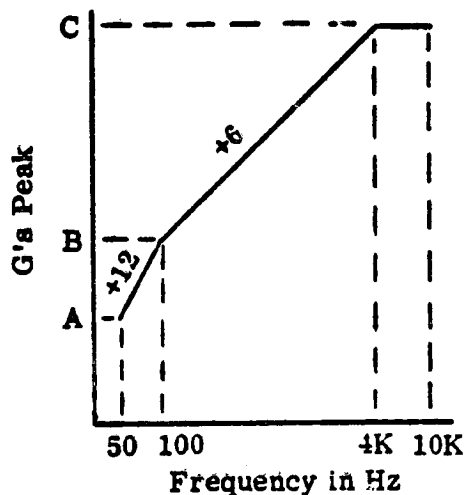
TABLE VI. PANELS IN THE SRB FORWARD SKIRT

Shock Source	SRB Station Number (X_b) of Component	Spectrum Amplitudes		
		A	B	C
Fwd Skirt/ Frustum Separation	$395 < X_b \leq 407$	94	325	15,000
	$407 < X_b \leq 419$	47	188	7,500
	$419 < X_b \leq 443$	24	94	3,750
	$443 < X_b \leq 491$	12	47	1,875
	$491 < X_b \leq 530.5$	N/A	N/A	N/A
Fwd Attach Bolt	$D = \text{Distance from Component to ET/SRB Fwd Attach Point (in.)}$			
	$0 < D \leq 12$	47	188	7,500
	$12 < D \leq 24$	24	94	3,750
	$24 < D \leq 48$	12	47	1,875
	$48 < D$	N/A	N/A	N/A

TABLE VII. SRB FORWARD SKIRT BULKHEAD

Shock Source	$D = \text{Distance to Component from SRB Nose Cone Separation Plane (in.)}$	Spectrum Amplitudes		
		A	B	C
Fwd Skirt/ Frustum Separation	$0 < D \leq 12$	188	750	30,000
	$12 < D \leq 24$	94	375	15,000
	$24 < D \leq 48$	47	188	7,500
	$48 < D \leq 96$	24	94	3,750
	$96 < D$	N/A	N/A	N/A

PYROTECHNIC SHOCK SPECTRUM CRITERIA
FOR COMPONENTS MOUNTED TO SPACE SHUTTLE STRUCTURE



SHOCK SPECTRUM

50 Hz @ A G's peak
 50 - 100 Hz @ +12 dB/oct
 100 Hz @ B G's peak
 100 - 4000 Hz @ +6 dB/oct
 4000 - 10000 Hz @ C G's peak

Note: For proper spectrum, use most severe of applicable levels from tables below.

TABLE VIII. SRB NOSE CONE

Shock Source	SRB Station Number (X_b) of Component	Spectrum Amplitudes		
		A	B	C
Fwd Skirt/ Frustum Separation	$395 > X_b \geq 383$	188	750	30,000
	$383 > X_b \geq 371$	94	375	15,000
	$371 > X_b \geq 347$	47	188	7,500
	$347 > X_b \geq 299$	24	94	3,750
	$299 > X_b \geq 275$	12	47	1,875
	$275 > X_b$	N/A	N/A	N/A

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SHOCK SPECTRA CRITERIA

TABLE IX. SRB WATER LANDING SHOCK TEST CRITERIA
(2 shocks/axis/mission)

SRB		Half-Sine Shock Pulse			
		Longitudinal		Lateral	
Sub-Zone	Structure	Amplitude (G's peak)	Duration (msec)	Amplitude (G's peak)	Duration (msec)
9-3	Nose Cap	N/A	N/A	N/A	N/A
9-2	Frustum-Fwd	50	50	15	100
9-1	Frustum-Aft	50	50	15	100
8-5	Forward Skirt - Avionics Panels	30	150	20	100
8-4	Forward Skirt - Bulkhead	30	150	20	100
8-3	Forward Skirt - Forward	30	150	20	100
8-2	Forward Skirt - Mid	30	150	20	100
8-1	Forward Skirt - Aft	30	150	20	100
7-4	Forward Fuel Cylinder Bulkhead	30	150	20	100
7-3	Forward Fuel Cylinder	30	150	7	100
7-2	Aft Fuel Cylinder	30	150	7	100
7-1	Aft Fuel Cylinder Bulkhead	30	150	27	100
6-2	Aft Skirt	30	150	27	100
6-1	Nozzle	30	150	27	100

Note: Both shocks for the Longitudinal direction shall be applied in the flight direction.

SHOCK SPECTRA CRITERIA

TABLE X. SRB PARACHUTE DEPLOYMENT SHOCK TEST CRITERIA
(2 shocks/axis/mission)

SRB		Half-Sine Shock Pulse			
		Longitudinal		Lateral	
Sub-Zone	Structure	Amplitude (G's peak)	Duration (msec)	Amplitude (G's peak)	Duration (msec)
9-3	Nose Cap	N/A	N/A	N/A	N/A
9-2	Frustum - Fwd	0.8	300	8.1	300
9-1	Frustum - Aft	0.8	300	8.1	300
8-5	Forward Skirt - Avionics Panels	3.1	300	7.3	300
8-4	Forward Skirt - Bulkhead	3.1	300	8.1	300
8-3	Forward Skirt - Forward	3.1	300	7.3	300
8-2	Forward Skirt - Mid	3.1	300	7.3	300
8-1	Forward Skirt - Aft	3.1	300	7.3	300
7-4	Forward Fuel Cylinder Bulkhead	3.1	300	7.3	300
7-3	Forward Fuel Cylinder	3.1	500	1.7	300
7-2	Aft Fuel Cylinder	3.1	500	1.7	300
7-1	Aft Fuel Cylinder Bulkhead	3.1	300	2.3	300
6-2	Aft Skirt	3.1	300	2.3	300
6-1	Nozzle	3.1	300	2.3	300

SECTION VIII. ACOUSTIC TEST SPECIFICATIONS

Zone 1 - ET Aft LH₂ Bulkhead (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	127.0	142.0	159.0
6.3	129.5	143.0	158.0
8.0	131.5	144.0	157.0
10.0	134.0	145.0	156.0
12.5	136.0	146.0	155.0
16.0	138.0	147.0	154.0
20.0	140.0	147.5	153.0
25.0	142.0	148.5	152.0
31.5	144.0	149.5	151.0
40.0	145.5	150.0	150.0
50.0	147.5	151.0	148.0
63.0	149.0	151.5	146.0
80.0	150.0	151.5	144.0
100.0	151.0	151.0	142.0
125.0	152.0	149.5	140.0
160.0	153.0	148.5	138.0
200.0	153.5	147.0	136.0
250.0	154.0	145.5	134.0
315.0	154.5	144.5	132.0
400.0	154.5	143.5	130.0
500.0	154.0	142.5	128.0
630.0	153.5	141.5	126.0
800.0	153.5	140.0	124.0
1000.0	153.0	139.0	122.0
1250.0	152.5	137.5	120.0
1600.0	151.5	136.0	118.0
2000.0	151.0	135.0	116.0
2500.0	150.0	133.5	114.0
3150.0	149.0	132.0	112.0
4000.0	147.5	130.5	110.0
5000.0	146.5	129.0	108.0
6300.0	145.0	128.0	106.0
8000.0	144.0	127.0	104.0
10000.0	143.0	126.0	102.0
Overall SPL	165.5	161.5	165.5
Duration	1 min	2 min	N/A

Subzone 2-1 - ET LH₂ Tank Cylinder, Inboard (Orbiter) Side, Aft
Section (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	131.0	125.0	159.0
6.3	132.5	126.0	158.0
8.0	134.0	127.0	157.0
10.0	135.5	128.0	156.0
12.5	136.5	129.0	155.0
16.0	138.0	130.0	154.0
20.0	139.0	131.0	153.0
25.0	140.0	132.0	152.0
31.5	141.5	133.0	151.0
40.0	142.0	134.0	150.0
50.0	143.0	135.0	148.0
63.0	144.0	136.0	146.0
80.0	144.5	137.0	144.0
100.0	145.0	138.5	142.0
125.0	145.5	140.0	140.0
160.0	145.5	139.0	138.0
200.0	146.0	138.5	136.0
250.0	146.0	138.0	134.0
315.0	146.0	137.5	132.0
400.0	145.5	137.0	130.0
500.0	145.5	136.0	128.0
630.0	145.0	135.5	126.0
800.0	144.5	135.0	124.0
1000.0	143.5	134.0	122.0
1250.0	143.0	133.0	120.0
1600.0	142.0	132.5	118.0
2000.0	141.0	132.0	116.0
2500.0	140.0	131.0	114.0
3150.0	139.5	130.0	112.0
4000.0	138.5	129.0	110.0
5000.0	137.5	128.5	108.0
6300.0	137.0	128.0	106.0
8000.0	136.0	127.0	104.0
10000.0	135.0	126.5	102.0
Overall SPL	158.0	150.0	165.5
Duration	1 min	2 min	N/A

Subzone 2-2 - ET LH₂ Tank Cylinder, Outboard Side, Aft Section
(General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	131.0	127.5	159.0
6.3	132.5	129.0	158.0
8.0	134.0	130.5	157.0
10.0	135.5	132.0	156.0
12.5	136.5	133.5	155.0
16.0	138.0	134.5	154.0
20.0	139.0	136.0	153.0
25.0	140.0	137.0	152.0
31.5	141.5	138.5	151.0
40.0	142.0	140.0	150.0
50.0	143.0	141.0	148.0
63.0	144.0	142.5	146.0
80.0	144.5	142.0	144.0
100.0	145.0	141.5	142.0
125.0	145.5	141.0	140.0
160.0	145.5	140.5	138.0
200.0	146.0	140.0	136.0
250.0	146.0	139.0	134.0
315.0	146.0	138.5	132.0
400.0	145.5	137.5	130.0
500.0	145.5	137.0	128.0
630.0	145.0	136.5	126.0
800.0	144.5	135.5	124.0
1000.0	143.5	134.5	122.0
1250.0	143.0	134.0	120.0
1600.0	142.0	133.0	118.0
2000.0	141.0	132.0	116.0
2500.0	140.0	131.0	114.0
3150.0	139.5	130.5	112.0
4000.0	138.5	129.5	110.0
5000.0	137.5	128.5	108.0
6300.0	137.0	128.0	106.0
8000.0	136.0	127.0	104.0
10000.0	135.0	126.0	102.0
Overall SPL	158.0	152.5	165.5
Duration	1 min	2 min	N/A

Subzone 2-3 - ET LH₂ Tank Cylinder, Inboard (Orbiter) S.de, Forward
Section (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

Geometric Mean Frequency (Hz)	Lift-off	In-flight Fluctuating Pressure	Oscillating Shock
5.0	130.0	141.5	159.0
6.3	131.5	142.0	158.0
8.0	133.0	142.5	157.0
10.0	134.5	143.0	156.0
12.5	135.5	143.5	155.0
16.0	137.0	144.0	154.0
20.0	138.0	144.0	153.0
25.0	139.0	144.5	152.0
31.5	140.0	145.0	151.0
40.0	141.0	145.5	150.0
50.0	142.0	146.0	148.0
63.0	142.5	147.0	146.0
80.0	142.5	148.0	144.0
100.0	143.0	149.0	142.0
125.0	143.5	149.5	140.0
160.0	143.5	150.5	138.0
200.0	143.5	152.0	136.0
250.0	143.5	153.5	134.0
315.0	143.0	155.0	132.0
400.0	143.0	154.0	130.0
500.0	142.5	153.0	128.0
630.0	142.0	152.0	126.0
800.0	141.5	151.0	124.0
1000.0	141.0	149.5	122.0
1250.0	140.0	149.0	120.0
1600.0	139.5	148.0	118.0
2000.0	138.5	147.0	116.0
2500.0	137.5	146.0	114.0
3150.0	137.0	145.0	112.0
4000.0	136.0	143.5	110.0
5000.0	135.0	142.5	108.0
6300.0	134.0	141.5	106.0
8000.0	133.0	140.5	104.0
10000.0	132.0	139.5	102.0
Overall SPL	155.5	164.0	165.5
Duration	1 min	2 min	N/A

Subzone 2-4 - ET LH₂ Tank Cylinder, Outboard Side, Forward Section
(General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

Geometric Mean Frequency (Hz)	Lift-off	In-flight Fluctuating Pressure	Oscillating Shock
5.0	130.0	127.5	159.0
6.3	131.5	129.0	158.0
8.0	133.0	130.5	157.0
10.0	134.5	132.0	156.0
12.5	135.5	133.5	155.0
16.0	137.0	134.5	154.0
20.0	138.0	136.0	153.0
25.0	139.0	137.0	152.0
31.5	140.0	138.5	151.0
40.0	141.0	140.0	150.0
50.0	142.0	141.0	148.0
63.0	142.5	142.5	146.0
80.0	142.5	142.0	144.0
100.0	143.0	141.5	142.0
125.0	143.5	141.0	140.0
160.0	143.5	140.5	138.0
200.0	143.5	140.0	136.0
250.0	143.5	139.0	134.0
315.0	143.0	138.5	132.0
400.0	143.0	137.5	130.0
500.0	142.5	137.0	128.0
630.0	142.0	136.5	126.0
800.0	141.5	135.5	124.0
1000.0	141.0	134.5	122.0
1250.0	140.0	134.0	120.0
1600.0	139.5	133.0	118.0
2000.0	138.5	132.0	116.0
2500.0	137.5	131.0	114.0
3150.0	137.0	130.5	112.0
4000.0	136.0	129.5	110.0
5000.0	135.0	128.5	108.0
6300.0	134.0	128.0	106.0
8000.0	133.0	127.0	104.0
10000.0	132.0	126.0	102.0
Overall SPL	155.5	152.5	165.5
Duration	1 min	2 min	N/A

Zone 3 - ET Intertank Section (General Specifications)

INTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	115.0	122.5	
6.3	116.5	123.5	
8.0	117.5	124.0	
10.0	119.0	125.0	N
12.5	120.0	126.5	
16.0	121.0	127.5	O
20.0	122.5	128.5	
25.0	123.5	130.0	T
31.5	129.0	136.5	
40.0	134.0	141.0	
50.0	134.5	141.0	
63.0	135.0	141.0	
80.0	135.5	141.0	A
100.0	135.5	141.0	
125.0	136.0	141.0	P
160.0	135.5	140.5	
200.0	135.5	140.0	P
250.0	135.5	139.0	
315.0	135.0	138.5	L
400.0	134.5	137.5	
500.0	132.5	136.0	I
630.0	130.5	134.0	
800.0	128.5	132.0	C
1000.0	127.0	130.0	
1250.0	124.0	128.0	A
1600.0	121.5	126.0	
2000.0	118.5	123.5	B
2500.0	115.5	121.0	
3150.0	112.5	118.5	L
4000.0	109.5	116.0	
5000.0	107.0	113.5	E
6300.0	104.0	111.5	
8000.0	101.0	109.0	
10000.0	98.0	106.5	
Overall SPL	146.5	151.5	
Duration	1 min	2 min	

Subzone 3-1 - ET Intertank Section, Panels 1, 2, and 3 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	130.0	139.0	159.0
6.3	131.5	141.0	158.0
8.0	132.5	143.0	157.0
10.0	134.0	145.0	156.0
12.5	135.0	147.0	155.0
16.0	136.0	149.0	154.0
20.0	137.5	151.0	153.0
25.0	138.5	153.0	152.0
31.5	139.0	155.0	151.0
40.0	140.0	155.0	150.0
50.0	140.5	154.0	148.0
63.0	141.0	152.5	146.0
80.0	141.5	151.0	144.0
100.0	141.5	149.5	142.0
125.0	142.0	148.0	140.0
160.0	141.5	147.0	138.0
200.0	141.5	145.5	136.0
250.0	141.5	144.5	134.0
315.0	141.0	144.0	132.0
400.0	140.5	143.0	130.0
500.0	140.0	142.0	128.0
630.0	139.5	141.5	126.0
800.0	139.0	141.0	124.0
1000.0	138.0	140.5	122.0
1250.0	137.5	140.0	120.0
1600.0	136.5	139.5	118.0
2000.0	135.5	139.0	116.0
2500.0	134.5	138.5	114.0
3150.0	133.5	138.5	112.0
4000.0	132.5	138.0	110.0
5000.0	132.0	138.0	108.0
6300.0	131.0	137.5	106.0
8000.0	130.0	137.0	104.0
10000.0	129.0	137.0	102.0
Overall SPL	153.5	163.5	165.5
Duration	1 min	2 min	N/A

Subzone 3-2 - ET Intertank Section, Panels 4 and 5 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N}/\text{m}^2$)

Geometric Mean Frequency (Hz)	Lift-off	In-flight Fluctuating Pressure	Oscillating Shock
5.0	130.0	141.5	159.0
6.3	131.5	142.5	158.0
8.0	132.5	143.0	157.0
10.0	134.0	143.5	156.0
12.5	135.0	144.5	155.0
16.0	136.0	145.0	154.0
20.0	137.5	146.0	153.0
25.0	138.5	146.5	152.0
31.5	139.0	147.0	151.0
40.0	140.0	148.0	150.0
50.0	140.5	148.5	148.0
63.0	141.0	149.0	146.0
80.0	141.5	150.0	144.0
100.0	141.5	150.5	142.0
125.0	142.0	151.0	140.0
160.0	141.5	150.5	138.0
200.0	141.5	150.0	136.0
250.0	141.5	149.0	134.0
315.0	141.0	148.5	132.0
400.0	140.5	148.0	130.0
500.0	140.0	148.0	128.0
630.0	139.5	147.5	126.0
800.0	139.0	147.0	124.0
1000.0	138.0	147.0	122.0
1250.0	137.5	146.5	120.0
1600.0	136.5	146.0	118.0
2000.0	135.5	145.5	116.0
2500.0	134.5	145.0	114.0
3150.0	133.5	144.5	112.0
4000.0	132.5	144.0	110.0
5000.0	132.0	143.5	108.0
6300.0	131.0	143.5	106.0
8000.0	130.0	143.0	104.0
10000.0	129.0	142.5	102.0
Overall SPL	153.5	162.5	165.5
Duration	1 min	2 min	N/A

Subzone 3-3 - ET Intertank Section, Panels 6, 7, and 8 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	130.0	127.0	159.0
6.3	131.5	128.5	158.0
8.0	132.5	130.0	157.0
10.0	134.0	131.5	156.0
12.5	135.0	133.0	155.0
16.0	136.0	134.5	154.0
20.0	137.5	136.0	153.0
25.0	138.5	137.5	152.0
31.5	139.0	139.0	151.0
40.0	140.0	141.0	150.0
50.0	140.5	143.0	148.0
63.0	141.0	144.5	146.0
80.0	141.5	144.0	144.0
100.0	141.5	143.0	142.0
125.0	142.0	142.0	140.0
160.0	141.5	141.0	138.0
200.0	141.5	140.5	136.0
250.0	141.5	139.5	134.0
315.0	141.0	139.0	132.0
400.0	140.5	138.5	130.0
500.0	140.0	138.0	128.0
630.0	139.5	138.0	126.0
800.0	139.0	137.0	124.0
1000.0	138.0	136.5	122.0
1250.0	137.5	136.0	120.0
1600.0	136.5	135.5	118.0
2000.0	135.5	135.0	116.0
2500.0	134.5	134.5	114.0
3150.0	133.5	134.0	112.0
4000.0	132.5	133.5	110.0
5000.0	132.0	133.0	108.0
6300.0	131.0	132.5	106.0
8000.0	130.0	131.5	104.0
10000.0	129.0	131.0	102.0
Overall SPL	153.5	154.0	165.5
Duration	1 min	2 min	N/A

Zone 4 - ET LOX Tank Cylindrical Section (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	130.0	137.0	159.0
6.3	131.5	138.0	158.0
8.0	132.5	139.0	157.0
10.0	134.0	140.0	156.0
12.5	135.0	141.0	155.0
16.0	136.0	142.0	154.0
20.0	137.5	143.0	153.0
25.0	138.5	144.0	152.0
31.5	139.0	145.0	151.0
40.0	140.0	146.0	150.0
50.0	140.5	147.0	148.0
63.0	141.0	148.0	146.0
80.0	141.5	149.0	144.0
100.0	141.5	150.0	142.0
125.0	142.0	150.0	140.0
160.0	141.5	149.5	138.0
200.0	141.5	148.5	136.0
250.0	141.5	148.0	134.0
315.0	141.0	147.0	132.0
400.0	140.5	145.5	130.0
500.0	140.0	144.5	128.0
630.0	139.5	143.5	126.0
800.0	139.0	143.0	124.0
1000.0	138.0	142.0	122.0
1250.0	137.5	141.0	120.0
1600.0	136.5	140.0	118.0
2000.0	135.5	139.5	116.0
2500.0	134.5	139.0	114.0
3150.0	133.5	138.5	112.0
4000.0	132.5	138.0	110.0
5000.0	132.0	138.0	108.0
6300.0	131.0	137.5	106.0
8000.0	130.0	137.0	104.0
10000.0	129.0	136.5	102.0
Overall SPL	153.5	160.0	165.5
Duration	1 min	2 min	N/A

Zone 5 - ET Ogive and Nose Cap (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>
5.0	130.0	137.0	159.0
6.3	131.5	138.0	158.0
8.0	132.5	139.0	157.0
10.0	134.0	140.0	156.0
12.5	135.0	141.0	155.0
16.0	136.0	142.0	154.0
20.0	137.5	143.0	153.0
25.0	138.5	144.0	152.0
31.5	139.0	145.0	151.0
40.0	140.0	146.0	150.0
50.0	140.5	147.0	148.0
63.0	141.0	148.0	146.0
80.0	141.5	149.0	144.0
100.0	141.5	150.0	142.0
125.0	142.0	150.0	140.0
160.0	141.5	149.5	138.0
200.0	141.5	148.5	136.0
250.0	141.5	148.0	134.0
315.0	141.0	147.0	132.0
400.0	140.5	145.5	130.0
500.0	140.0	144.5	128.0
630.0	139.5	143.5	126.0
800.0	139.0	143.0	124.0
1000.0	138.0	142.0	122.0
1250.0	137.5	141.0	120.0
1600.0	136.5	140.0	118.0
2000.0	135.5	139.5	116.0
2500.0	134.5	139.0	114.0
3150.0	133.5	138.5	112.0
4000.0	132.5	138.0	110.0
5000.0	132.0	138.0	108.0
6300.0	131.0	137.5	106.0
8000.0	130.0	137.0	104.0
10000.0	129.0	136.5	102.0
Overall SPL	153.5	160.0	165.5
Duration	1 min	2 min	N/A

Subzone 6-1 - SRB Nozzle--Stations 1990-1830 (General Specifications)

INTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0				153.5
6.3				154.5
8.0				156.5
10.0	N	N	N	158.5
12.5				159.0
16.0	O	O	O	164.0
20.0				169.5
25.0	T	T	T	165.0
31.5				162.5
40.0				164.0
50.0				164.5
63.0				166.0
80.0	A	A	A	166.5
100.0				165.0
125.0	P	P	P	173.0
160.0				177.5
200.0	P	P	P	167.0
250.0				167.0
315.0	L	L	L	171.0
400.0				165.5
500.0	I	I	I	164.5
630.0				164.0
800.0	C	C	C	163.0
1000.0				162.0
1250.0	A	A	A	161.0
1600.0				160.0
2000.0	B	B	B	159.0
2500.0				158.0
3150.0	L	L	L	157.0
4000.0				156.0
5000.0	E	E	E	155.0
6300.0				154.0
8000.0				153.0
10000.0				152.0
Overall SPL	N/A	N/A	N/A	182.0
Duration	N/A	N/A	N/A	60 sec plus 30 sec per mission

Subzone 6-1 - SRB Nozzle--Stations 1990-1830 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N}/\text{m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	132.0	142.5	159.0	153.0
6.3	133.0	143.5	158.0	156.0
8.0	134.0	144.5	157.0	157.5
10.0	135.5	145.5	156.0	161.0
12.5	137.0	146.5	155.0	158.0
16.0	138.0	147.5	154.0	157.5
20.0	139.5	148.5	153.0	159.5
25.0	141.0	149.5	152.0	158.0
31.5	142.0	150.0	151.0	157.0
40.0	143.5	151.0	150.0	157.5
50.0	144.5	152.0	148.0	157.5
63.0	145.5	153.0	146.0	157.5
80.0	146.0	152.0	144.0	156.5
100.0	146.5	151.0	142.0	156.0
125.0	147.0	150.5	140.0	157.0
160.0	147.5	149.5	138.0	157.5
200.0	147.5	149.0	136.0	157.5
250.0	147.5	148.0	134.0	156.5
315.0	147.0	147.0	132.0	159.5
400.0	147.0	146.0	130.0	157.0
500.0	146.5	145.0	128.0	155.5
630.0	146.0	144.0	126.0	154.0
800.0	145.5	143.5	124.0	154.0
1000.0	145.0	143.0	122.0	153.0
1250.0	144.5	142.0	120.0	152.0
1600.0	144.0	141.5	118.0	151.0
2000.0	143.5	141.0	116.0	150.0
2500.0	143.0	140.5	114.0	149.0
3150.0	142.0	140.0	112.0	148.0
4000.0	141.0	139.5	110.0	147.0
5000.0	140.0	139.0	108.0	146.0
6300.0	139.0	138.0	106.0	145.0
8000.0	138.0	137.5	104.0	144.0
10000.0	137.0	137.0	102.0	143.0
Overall SPL	159.5	162.5	165.5	172.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 6-2 - SRB Aft Skirt--Stations 1930-1837 (General Specifications)

INTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N}/\text{m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0				134.0
6.3				136.0
8.0				141.5
10.0	N	N	N	143.0
12.5				139.0
16.0	O	O	O	137.0
20.0				136.5
25.0	T	T	T	135.0
31.5				133.0
40.0				134.0
50.0				134.5
63.0				134.0
80.0	A	A	A	134.0
100.0				135.5
125.0	P	P	P	141.0
160.0				143.5
200.0	P	P	P	138.0
250.0				137.5
315.0	L	L	L	137.5
400.0				137.5
500.0	I	I	I	137.5
630.0				137.0
800.0	C	C	C	137.0
1000.0				136.5
1250.0	A	A	A	135.5
1600.0				134.5
2000.0	B	B	B	133.5
2500.0				132.5
3150.0	L	L	L	131.5
4000.0				130.5
5000.0	E	E	E	129.5
6300.0				128.5
8000.0				127.5
10000.0				126.5
Overall SPL	N/A	N/A	N/A	152.5
Duration	N/A	N/A	N/A	60 sec plus 30 sec per mission

Subzone 6-2 - SRB Aft Skirt--Stations 1930-1837 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	132.0	142.5	159.0	140.5
6.3	133.0	143.5	158.0	142.0
8.0	134.0	144.5	157.0	143.0
10.0	135.5	145.5	156.0	144.0
12.5	137.0	146.5	155.0	145.0
16.0	138.0	147.5	154.0	146.0
20.0	139.5	148.5	153.0	147.0
25.0	141.0	149.5	152.0	148.5
31.5	142.0	150.0	151.0	149.5
40.0	143.5	151.0	150.0	150.5
50.0	144.5	152.0	148.0	151.5
63.0	145.5	153.0	146.0	153.0
80.0	146.0	152.0	144.0	154.0
100.0	146.5	151.0	142.0	155.0
125.0	147.0	150.5	140.0	155.0
160.0	147.5	149.5	138.0	155.0
200.0	147.5	149.0	136.0	155.0
250.0	147.5	148.0	134.0	155.0
315.0	147.0	147.0	132.0	154.0
400.0	147.0	146.0	130.0	153.0
500.0	146.5	145.0	128.0	152.5
630.0	146.0	144.0	126.0	151.5
800.0	145.5	143.5	124.0	150.5
1000.0	145.0	143.0	122.0	149.5
1250.0	144.5	142.0	120.0	148.5
1600.0	144.0	141.5	118.0	147.0
2000.0	143.5	141.0	116.0	145.0
2500.0	143.0	140.5	114.0	144.0
3150.0	142.0	140.0	112.0	143.5
4000.0	141.0	139.5	110.0	142.0
5000.0	140.0	139.0	108.0	140.0
6300.0	139.0	138.0	106.0	139.0
8000.0	138.0	137.5	104.0	137.5
10000.0	137.0	137.0	102.0	136.0
Overall SPL	159.5	162.5	165.5	166.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 7-1 - SRB Aft Fuel Bulkhead-- Stations 1875-1818 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0				134.0
6.3				136.0
8.0				141.5
10.0	N	N	N	143.0
12.5				139.0
16.0	O	O	O	137.0
20.0				136.5
25.0	T	T	T	135.0
31.5				133.0
40.0				134.0
50.0				134.5
63.0				134.0
80.0	A	A	A	134.0
100.0				135.5
125.0	P	P	P	141.0
160.0				143.5
200.0	P	P	P	138.0
250.0				137.5
315.0	L	L	L	137.5
400.0				137.5
500.0	I	I	I	137.5
630.0				137.0
800.0	C	C	C	137.0
1000.0				136.5
1250.0	A	A	A	135.5
1600.0				134.5
2000.0	B	B	B	133.5
2500.0				132.5
3150.0	L	L	L	131.5
4000.0				130.5
5000.0	E	E	E	129.5
6300.0				128.5
8000.0				127.5
10000.0				126.5
Overall SPL				152.5
Duration				60 sec plus 30 sec per mission

**Subzone 7-2 - SRB Aft Fuel Cylinder--Stations 1837-1180 (General
(Specifications)**

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	132.0	130.5	159.0	151.5
6.3	133.0	131.5	158.0	152.5
8.0	134.0	132.5	157.0	153.5
10.0	135.5	133.5	156.0	154.5
12.5	137.0	134.5	155.0	155.5
16.0	138.0	135.5	154.0	156.5
20.0	139.5	136.5	153.0	157.5
25.0	141.0	137.5	152.0	158.5
31.5	142.0	138.5	151.0	159.5
40.0	143.5	139.0	150.0	160.5
50.0	144.5	140.0	148.0	162.0
63.0	145.5	141.0	146.0	162.5
80.0	146.0	142.0	144.0	163.5
100.0	146.5	143.0	142.0	164.0
125.0	147.0	144.0	140.0	164.0
160.0	147.5	144.0	138.0	164.5
200.0	147.5	144.5	136.0	164.0
250.0	147.5	145.0	134.0	163.5
315.0	147.0	145.0	132.0	163.0
400.0	147.0	144.5	130.0	162.0
500.0	146.5	144.0	128.0	161.0
630.0	146.0	143.5	126.0	160.0
800.0	145.5	142.5	124.0	159.0
1000.0	145.0	142.0	122.0	158.0
1250.0	144.5	141.0	120.0	157.0
1600.0	144.0	140.5	118.0	156.0
2000.0	143.5	140.0	116.0	155.0
2500.0	143.0	139.0	114.0	154.0
3150.0	142.0	138.0	112.0	153.0
4000.0	141.0	137.5	110.0	152.0
5000.0	140.0	137.0	108.0	151.0
6300.0	139.0	136.0	106.0	150.0
8000.0	138.0	135.5	104.0	149.0
10000.0	137.0	135.0	102.0	148.0
Overall SPL	159.5	156.0	165.5	175.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 7-2-1 - SRB/ET Attach Ring--Station 1511 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

Geometric Mean Frequency (Hz)	Lift-off	In-flight Fluctuating Pressure	Oscillating Shock	Reentry
5.0	132.0	130.5	159.0	148.0
6.3	133.0	131.5	158.0	149.0
8.0	134.0	132.5	157.0	150.0
10.0	135.5	133.5	156.0	151.5
12.5	137.0	134.5	155.0	152.5
16.0	138.0	135.5	154.0	153.5
20.0	139.5	136.5	153.0	154.5
25.0	141.0	137.5	152.0	156.0
31.5	142.0	138.5	151.0	157.0
40.0	143.5	139.0	150.0	158.0
50.0	144.5	140.0	148.0	159.0
63.0	145.5	141.0	146.0	160.5
80.0	146.0	142.0	144.0	161.5
100.0	146.5	143.0	142.0	162.0
125.0	147.0	144.0	140.0	162.5
160.0	147.5	144.0	138.0	163.0
200.0	147.5	144.5	136.0	163.0
250.0	147.5	145.0	134.0	163.0
315.0	147.0	145.0	132.0	163.0
400.0	147.0	144.5	130.0	162.5
500.0	146.5	144.0	128.0	161.5
630.0	146.0	143.5	126.0	161.0
800.0	145.5	142.5	124.0	159.5
1000.0	145.0	142.0	122.0	158.5
1250.0	144.5	141.0	120.0	157.5
1600.0	144.0	140.5	118.0	156.5
2000.0	143.5	140.0	116.0	155.0
2500.0	143.0	139.0	114.0	154.0
3150.0	142.0	138.0	112.0	153.0
4000.0	141.0	137.5	110.0	152.0
5000.0	140.0	137.0	108.0	151.0
6300.0	139.0	136.0	106.0	150.0
8000.0	138.0	135.5	104.0	149.0
10000.0	137.0	135.0	102.0	148.0
Overall SPL	159.5	156.0	165.5	174.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 7-3 - SRB Forward Fuel Cylinder--Stations 1180-524 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	133.0	130.5	159.0	147.0
6.3	134.0	131.5	158.0	149.0
8.0	135.0	132.5	157.0	151.5
10.0	136.0	133.5	156.0	153.0
12.5	137.5	134.5	155.0	154.0
16.0	138.0	135.5	154.0	153.0
20.0	139.0	136.5	153.0	151.5
25.0	140.0	137.5	152.0	151.0
31.5	141.5	138.5	151.0	151.0
40.0	142.0	139.0	150.0	151.5
50.0	143.0	140.0	148.0	153.0
63.0	144.0	141.0	146.0	154.5
80.0	144.5	142.0	144.0	156.0
100.0	144.5	143.0	142.0	157.0
125.0	144.5	144.0	140.0	157.5
160.0	144.5	144.0	138.0	156.0
200.0	144.5	144.5	136.0	154.0
250.0	144.5	145.0	134.0	153.0
315.0	144.0	145.0	132.0	151.0
400.0	144.0	144.5	130.0	149.0
500.0	143.0	144.0	128.0	147.0
630.0	142.5	143.5	126.0	145.0
800.0	142.0	142.5	124.0	142.5
1000.0	141.5	142.0	122.0	140.0
1250.0	140.5	141.0	120.0	138.5
1600.0	140.0	140.5	118.0	136.5
2000.0	139.0	140.0	116.0	134.5
2500.0	138.5	139.0	114.0	132.5
3150.0	137.5	138.0	112.0	130.5
4000.0	136.0	137.5	110.0	128.5
5000.0	135.0	137.0	108.0	127.0
6300.0	134.0	136.0	106.0	125.0
8000.0	133.5	135.5	104.0	123.0
10000.0	132.5	135.0	102.0	121.0
Overall SPL	156.5	156.5	165.5	167.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 7-4 - SRB Forward Fuel Bulkhead--Stations 531-486 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	106.0	105.5		123.0
6.3	108.5	107.5		126.0
8.0	110.5	110.0		129.0
10.0	113.0	112.0	N	131.5
12.5	115.5	114.5		134.0
16.0	117.5	116.5	O	135.5
20.0	119.5	118.5		137.5
25.0	121.5	120.5	T	137.5
31.5	123.5	122.5		138.0
40.0	125.5	124.5		139.0
50.0	127.5	126.5		139.0
63.0	129.0	128.5		139.5
80.0	131.0	131.0	A	140.0
100.0	132.5	133.0		140.5
125.0	133.5	135.0	P	141.0
160.0	134.5	136.0		141.5
200.0	134.5	136.5	P	141.5
250.0	134.0	137.0		141.5
315.0	134.0	137.0	L	141.5
400.0	132.5	135.5		140.5
500.0	131.0	134.0	I	139.0
630.0	129.5	132.5		137.0
800.0	127.5	130.5	C	134.5
1000.0	126.0	129.0		133.0
1250.0	124.0	127.0	A	130.5
1600.0	122.0	125.5		128.0
2000.0	120.5	124.0	B	126.0
2500.0	118.5	122.0		123.5
3150.0	116.0	119.5	L	120.5
4000.0	113.5	117.5		117.5
5000.0	111.5	116.0	E	115.0
6300.0	108.5	113.5		111.5
8000.0	106.0	111.5		109.0
10000.0	104.0	110.0		106.5
Overall SPL	144.0	146.0		152.5
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission		60 sec plus 30 sec per mission

Zone 8 - SRB Forward Skirt--Stations 524-395 (General Specifications)

INTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

Geometric Mean Frequency (Hz)	Lift-off	In-flight Fluctuating Pressure	Oscillating Shock	Reentry
5.0	106.0	105.5		123.0
6.3	108.5	107.5		126.0
8.0	110.5	110.0		129.0
10.0	113.0	112.0	N	131.5
12.5	115.5	114.5		134.0
16.0	117.5	116.5	O	135.5
20.0	119.5	118.5		137.5
25.0	121.5	120.5	T	137.5
31.5	123.5	122.5		138.0
40.0	125.5	124.5		139.0
50.0	127.5	126.5		139.0
63.0	129.0	128.5		139.5
80.0	131.0	131.0	A	140.0
100.0	132.5	133.0		140.5
125.0	133.5	135.0	P	141.0
160.0	134.5	136.0		141.5
200.0	134.5	136.5	P	141.5
250.0	134.0	137.0		141.5
315.0	134.0	137.0	L	141.5
400.0	132.5	135.5		140.5
500.0	131.0	134.0	I	139.0
630.0	129.5	132.5		137.0
800.0	127.5	130.5	C	134.5
1000.0	126.0	129.0		133.0
1250.0	124.0	127.0	A	130.5
1600.0	122.0	125.5		128.0
2000.0	120.5	124.0	B	126.0
2500.0	118.5	122.0		123.5
3150.0	116.0	119.5	L	120.5
4000.0	113.5	117.5		117.5
5000.0	111.5	116.0	E	115.0
6300.0	108.5	113.5		111.5
8000.0	106.0	111.5		109.0
10000.0	104.0	110.0		106.5
Overall SPL	144.0	146.0		152.5
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission		60 sec plus 30 sec per mission

Subzone 8-1 - SRB Forward Skirt--Stations 524-485 (General
Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	131.0	130.5	159.0	148.0
6.3	132.5	131.5	158.0	150.0
8.0	133.0	132.5	157.0	152.5
10.0	134.5	133.5	156.0	154.5
12.5	135.5	134.5	155.0	155.5
16.0	136.5	135.5	154.0	156.0
20.0	137.5	136.5	153.0	157.0
25.0	138.5	137.5	152.0	156.0
31.5	139.5	138.5	151.0	155.0
40.0	140.0	139.0	150.0	154.0
50.0	141.0	140.0	148.0	153.0
63.0	141.5	141.0	146.0	152.0
80.0	142.0	142.0	144.0	150.5
100.0	142.5	143.0	142.0	150.0
125.0	142.5	144.0	140.0	149.5
160.0	142.5	144.0	138.0	149.5
200.0	142.5	144.5	136.0	148.5
250.0	142.0	145.0	134.0	147.0
315.0	142.0	145.0	132.0	146.0
400.0	141.5	144.5	130.0	144.0
500.0	141.0	144.0	128.0	143.0
630.0	140.5	143.5	126.0	141.5
800.0	139.5	142.5	124.0	140.0
1000.0	139.0	142.0	122.0	138.5
1250.0	138.0	141.0	120.0	137.5
1600.0	137.0	140.5	118.0	136.0
2000.0	136.5	140.0	116.0	134.5
2500.0	135.5	139.0	114.0	133.5
3150.0	134.5	138.0	112.0	131.5
4000.0	133.5	137.5	110.0	130.0
5000.0	132.5	137.0	108.0	128.5
6300.0	131.0	136.0	106.0	127.0
8000.0	130.0	135.5	104.0	126.0
10000.0	129.0	135.0	102.0	124.5
Overall SPL	154.5	156.0	165.5	166.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 8-2 - SRB Forward Skirt--Stations 484-434 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	131.0	130.5	159.0	148.0
6.3	132.5	131.5	158.0	150.0
8.0	133.0	132.5	157.0	151.5
10.0	134.5	133.5	156.0	153.0
12.5	135.5	134.5	155.0	153.5
16.0	136.5	135.5	154.0	154.5
20.0	137.5	136.5	153.0	155.0
25.0	138.5	137.5	152.0	154.5
31.5	139.5	138.5	151.0	154.0
40.0	140.0	139.0	150.0	153.5
50.0	141.0	140.0	148.0	152.5
63.0	141.5	141.0	146.0	152.0
80.0	142.0	142.0	144.0	151.0
100.0	142.5	143.0	142.0	150.0
125.0	142.5	144.0	140.0	149.0
160.0	142.5	144.0	138.0	148.0
200.0	142.5	144.5	136.0	147.0
250.0	142.0	145.0	134.0	146.0
315.0	142.0	145.0	132.0	145.0
400.0	141.5	144.5	130.0	144.0
500.0	141.0	144.0	128.0	143.0
630.0	140.5	143.5	126.0	141.5
800.0	139.5	142.5	124.0	140.0
1000.0	139.0	142.0	122.0	138.5
1250.0	138.0	141.0	120.0	137.5
1600.0	137.0	140.5	118.0	135.5
2000.0	136.5	140.0	116.0	134.5
2500.0	135.5	139.0	114.0	133.0
3150.0	134.5	138.0	112.0	131.5
4000.0	133.5	137.5	110.0	130.0
5000.0	132.5	137.0	108.0	128.5
6300.0	131.0	136.0	106.0	127.0
8000.0	130.0	135.5	104.0	126.0
10000.0	129.0	135.0	102.0	124.5
Overall SPL	154.5	156.0	165.5	165.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 8-3 - SRB Forward Skirt--Stations 433-395 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	131.0	130.5	159.0	148.0
6.3	132.5	131.5	158.0	149.0
8.0	133.0	132.5	157.0	150.5
10.0	134.5	133.5	156.0	151.5
12.5	135.5	134.5	155.0	152.0
16.0	136.5	135.5	154.0	152.5
20.0	137.5	136.5	153.0	153.0
25.0	138.5	137.5	152.0	153.0
31.5	139.5	138.5	151.0	153.5
40.0	140.0	139.0	150.0	153.0
50.0	141.0	140.0	148.0	152.5
63.0	141.5	141.0	146.0	152.0
80.0	142.0	142.0	144.0	151.5
100.0	142.5	143.0	142.0	151.0
125.0	142.5	144.0	140.0	151.0
160.0	142.5	144.0	138.0	151.5
200.0	142.5	144.5	136.0	152.0
250.0	142.0	145.0	134.0	153.0
315.0	142.0	145.0	132.0	154.0
400.0	141.5	144.5	130.0	154.0
500.0	141.0	144.0	128.0	154.0
630.0	140.5	143.5	126.0	153.0
800.0	139.5	142.5	124.0	151.5
1000.0	139.0	142.0	122.0	151.0
1250.0	138.0	141.0	120.0	149.5
1600.0	137.0	140.5	118.0	148.0
2000.0	136.5	140.0	116.0	147.0
2500.0	135.5	139.0	114.0	145.5
3150.0	134.5	138.0	112.0	144.0
4000.0	133.5	137.5	110.0	142.5
5000.0	132.5	137.0	108.0	141.0
6300.0	131.0	136.0	106.0	139.0
8000.0	130.0	135.5	104.0	138.0
10000.0	129.0	135.0	102.0	136.5
Overall SPL	154.5	156.0	165.5	166.5
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Zone 9 - SRB Frustum and Nose Cone--Stations 395-200 (General Specifications)

INTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	131.0	124.5		139.5
6.3	132.0	125.0		140.0
8.0	132.0	125.5		140.5
10.0	132.5	125.5	N	140.5
12.5	132.0	125.0		140.0
16.0	131.0	124.5	O	139.0
20.0	130.0	123.0		137.0
25.0	128.5	121.5	T	134.5
31.5	126.5	120.0		132.0
40.0	125.0	118.0		130.5
50.0	122.5	116.0		127.0
63.0	123.0	117.0		126.5
80.0	123.5	118.0	A	126.0
100.0	123.5	119.0		126.5
125.0	124.0	120.0	P	126.0
160.0	123.5	120.0		126.0
200.0	123.5	120.5	P	125.0
250.0	123.5	121.0		124.5
315.0	123.0	121.0	L	124.0
400.0	122.5	120.5		122.0
500.0	122.0	120.0	I	121.0
630.0	121.5	119.5		119.5
800.0	121.0	118.5	C	118.0
1000.0	120.0	118.0		116.5
1250.0	119.5	117.0	A	115.0
1600.0	118.5	116.5		114.0
2000.0	117.5	116.0	B	112.5
2500.0	116.5	115.0		111.0
3150.0	114.5	113.0	L	108.5
4000.0	111.5	110.5		105.0
5000.0	109.0	108.0	E	101.5
6300.0	106.0	105.0		98.5
8000.0	103.0	102.5		95.5
10000.0	100.0	100.5		92.0
Overall SPL	141.5	136.0		148.5
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission		60 sec plus 30 sec per mission

Subzone 9-1 - SRB Frustum--Stations 395-275 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 $\mu\text{N}/\text{m}^2$)

Geometric Mean Frequency (Hz)	Lift-off	In-flight Fluctuating Pressure	Oscillating Shock	Reentry
5.0	131.0	130.5	159.0	146.0
6.3	132.5	131.5	158.0	147.0
8.0	133.0	132.5	157.0	148.0
10.0	134.5	133.5	156.0	149.0
12.5	135.5	134.5	155.0	149.5
16.0	136.0	135.5	154.0	150.0
20.0	137.5	136.5	153.0	151.0
25.0	138.5	137.5	152.0	151.0
31.5	139.0	138.5	151.0	151.0
40.0	140.0	139.0	150.0	151.0
50.0	140.5	140.0	148.0	150.0
63.0	141.0	141.0	146.0	148.5
80.0	141.5	142.0	144.0	148.0
100.0	141.5	143.0	142.0	148.0
125.0	142.0	144.0	140.0	148.0
160.0	141.5	144.0	138.0	149.0
200.0	141.5	144.5	136.0	149.5
250.0	141.5	145.0	134.0	149.0
315.0	141.0	145.0	132.0	148.5
400.0	140.5	144.5	130.0	147.0
500.0	140.0	144.0	128.0	146.0
630.0	139.5	143.5	126.0	144.5
800.0	139.0	142.5	124.0	143.0
1000.0	138.0	142.0	122.0	141.5
1250.0	137.5	141.0	120.0	140.0
1600.0	136.5	140.5	118.0	139.0
2000.0	135.5	140.0	116.0	137.5
2500.0	134.5	139.0	114.0	136.5
3150.0	133.5	138.0	112.0	135.0
4000.0	132.5	137.5	110.0	133.5
5000.0	132.0	137.0	108.0	132.0
6300.0	131.0	136.0	106.0	131.0
8000.0	130.0	135.5	104.0	130.0
10000.0	129.0	135.0	102.0	128.5
Overall SPL	154.0	156.0	165.5	162.5
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Subzone 9-2 - SRB Nose Cone--Stations 275-200 (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	131.0	130.5	159.0	144.0
6.3	132.5	131.5	158.0	145.5
8.0	133.0	132.5	157.0	147.0
10.0	134.5	133.5	156.0	148.0
12.5	135.5	134.5	155.0	149.0
16.0	136.0	135.5	154.0	150.0
20.0	137.5	136.5	153.0	148.0
25.0	138.5	137.5	152.0	149.0
31.5	139.0	138.5	151.0	150.0
40.0	140.0	139.0	150.0	152.0
50.0	140.5	140.0	148.0	152.5
63.0	141.0	141.0	146.0	153.0
80.0	141.5	142.0	144.0	153.0
100.0	141.5	143.0	142.0	153.5
125.0	142.0	144.0	140.0	152.5
160.0	141.5	144.0	138.0	151.5
200.0	141.5	144.5	136.0	149.0
250.0	141.5	145.0	134.0	147.0
315.0	141.0	145.0	132.0	145.5
400.0	140.5	144.5	130.0	143.0
500.0	140.0	144.0	128.0	141.0
630.0	139.5	143.5	126.0	139.0
800.0	139.0	142.5	124.0	137.0
1000.0	138.0	142.0	122.0	135.5
1250.0	137.5	141.0	120.0	133.5
1600.0	136.5	140.5	118.0	131.5
2000.0	135.5	140.0	116.0	130.0
2500.0	134.5	139.0	114.0	127.5
3150.0	133.5	138.0	112.0	125.5
4000.0	132.5	137.5	110.0	124.0
5000.0	132.0	137.0	108.0	122.0
6300.0	131.0	136.0	106.0	120.0
8000.0	130.0	135.5	104.0	118.5
10000.0	129.0	135.0	102.0	116.0
Overall SPL	154.0	156.0	165.5	163.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Zone 10 - Space Shuttle Main Engine (General Specifications)

EXTERNAL

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	125.0	138.5	159.0	
6.3	127.5	139.0	158.0	
8.0	130.0	139.5	157.0	
10.0	133.0	140.0	156.0	N
12.5	135.5	140.5	155.0	
16.0	138.0	141.0	154.0	O
20.0	141.5	141.5	153.0	
25.0	144.5	142.0	152.0	T
31.5	146.5	142.5	151.0	
40.0	148.5	143.0	150.0	
50.0	150.0	143.0	148.0	
63.0	151.0	142.5	146.0	
80.0	152.0	142.0	144.0	A
100.0	152.5	141.5	142.0	
125.0	153.0	141.0	140.0	P
160.0	153.5	140.0	138.0	
200.0	153.5	139.0	136.0	P
250.0	153.5	138.0	134.0	
315.0	153.5	137.0	132.0	L
400.0	153.0	136.0	130.0	
500.0	153.0	135.0	128.0	I
630.0	152.5	134.0	126.0	
800.0	152.0	133.0	124.0	C
1000.0	151.5	132.0	122.0	
1250.0	151.0	131.0	120.0	A
1600.0	150.5	130.0	118.0	
2000.0	150.0	129.0	116.0	B
2500.0	149.5	127.5	114.0	
3150.0	149.0	126.5	112.0	L
4000.0	148.5	125.5	110.0	
5000.0	147.5	124.5	108.0	E
6300.0	146.5	123.5	106.0	
8000.0	145.5	122.5	104.0	
10000.0	144.5	121.5	102.0	
Overall SPL	165.0	154.0	165.5	
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	

SECTION IX. TRANSPORTATION SPECIFICATIONS

A. Vibration

Vibration test frequencies should be swept logarithmically from 5 Hz to the maximum frequency and back to 5 Hz at 1 oct/min in each of three mutually perpendicular axes. Criteria below 5 Hz are for design consideration only, and no test is required. A 15 minute dwell is required at each major component resonance at the amplitude specified for the sweep test.

1. Aircraft

- Jet (5-200-5 Hz @ 1 oct/min)
 - 5 - 10 Hz @ 0.022 in. D. A. Disp.
 - 10 - 35 Hz @ 0.11 G's peak
 - 35 - 200 Hz @ 0.0017 in. D. A. Disp.
 - 200 - 2000 Hz @ 3.5 G's peak
- Propeller (5-700-5 Hz @ 1 oct/min)
 - 2 - 4 Hz @ 0.42 in. D. A. Disp.*
 - 4 - 5 Hz @ 0.35 G's peak*
 - 5 - 12 Hz @ 0.35 G's peak
 - 12 - 55 Hz @ 0.046 in. D. A. Disp.
 - 55 - 300 Hz @ 7.0 G's peak
 - 300 - 700 Hz @ 3.5 G's peak
- Helicopter (5-600-5 Hz @ 1 oct/min)
 - 5 - 12 Hz @ 0.22 in. D. A. Disp.
 - 12 - 40 Hz @ 1.6 G's peak
 - 40 - 55 Hz @ 0.019 in. D. A. Disp.
 - 55 - 120 Hz @ 3.0 G's peak
 - 120 - 170 Hz @ 0.0040 in. D. A. Disp.
 - 170 - 220 Hz @ 6.0 G's peak
 - 220 - 260 Hz @ 0.0024 in. D. A. Disp.
 - 260 - 600 Hz @ 8.0 G's peak

* Design Criteria Only--no test required.

2. Trucks

- Smooth Paved Roads (5-300-5 Hz @ 1 oct/min)

- 1 - 4 Hz @ 0.43 in. D. A. Disp. *
- 4 - 5 Hz @ 0.35 G's peak*
- 5 - 150 Hz @ 0.35 G's peak
- 150 - 300 Hz @ 0.06 G's peak

- All Road Conditions (5-1000-5 Hz @ 1 oct/min)

- 1 - 7 Hz @ 1.7 G's peak*
- 7 - 15 Hz @ 1.7 G's peak
- 15 - 1000 Hz @ 0.7 G's peak

3. Trains

- Normal Railroad Operations (5-2000-5 Hz @ 1 oct/min)

- 2 - 3 Hz @ 2.6 in. D. A. Disp. *
- 3 - 6 Hz @ 1.2 G's peak*
- 6 - 130 Hz @ 1.2 G's peak
- 130 - 185 Hz @ 0.0014 in. D. A. Disp.
- 185 - 2000 Hz @ 2.5 G's peak

4. Ships

- Normal Maneuvers (5-300-5 Hz @ 1 oct/min)

- 0.1 - 0.3 Hz @ 0.35 G's peak*
- 0.3 - 1.5 Hz @ 0.35 G's peak*
- 1.5 - 4 Hz @ 0.10 G's peak*
- 4 - 5 Hz @ 0.12 in. D. A. Disp. *
- 5 - 11 Hz @ 0.12 in. D. A. Disp.
- 11 - 300 Hz @ 0.75 G's peak

B. Shock

Shock tests should be conducted by applying five shocks in each of three mutually perpendicular axes (15 shocks total). Any shock pulse that results in a spectrum as severe as that presented below will be acceptable. The spectrum is based on the response of an undamped series of single-degree-of-freedom spring-mass systems.

* Design Criteria Only--no test required.

1. Railroad

● Car Humping Conditions (5 shocks per axis)

20 - 160 Hz @ +6 dB/oct
160 - 340 Hz @ 500 G's peak
340 - 400 Hz @ -6 dB/oct

SECTION X. HANDLING SPECIFICATIONS

Where equipment design allows, equipment shall be tested to handling specifications as described below. If normal equipment design does not allow this type testing, the procedures and required protection in handling are to be submitted to MSFC, ED23, for approval.

A. Transit Drop Test

This procedure shall be used for equipment, in its transit or combination case as prepared for field use, to determine if the equipment is capable of withstanding the shocks normally induced by loading and unloading of equipment.

B. Test Conditions

The test item shall be in its transit or combination case. For equipment 1,000 lb or less, the floor or barrier receiving the impact shall be of solid, 2-in. thick plywood, backed by either concrete or a rigid steel frame. For equipment over 1,000 lb, the floor or barrier shall be concrete or its equivalent.

C. Performance of Test

Subject the test item to the number and heights of drop as required in Table XI. Upon completion of the test, the test item shall be operated and the results compared with the data obtained in accordance with the following:

Prior to proceeding with any of the test methods, the test item shall be operated under standard ambient conditions and a record made of all data necessary to determine compliance with required performance. These data shall provide the criteria for checking satisfactory performance of the test item either during, or at the conclusion of the test, or both, as required. Certification by signature and date block is required.

The test item shall then be visually inspected and a record made of any damage/deterioration resulting from the test. If a test chamber is used for the test, perform a visual inspection of the test item within the chamber at test conditions, when possible. Upon completion of the test, visually inspect the test item again after the test item has been returned to standard ambient conditions. Deterioration, corrosion, or change in tolerance limits or any internal or external parts which could in any manner prevent the test item from meeting operational service or maintenance requirements shall provide reason to consider the test item as having failed to withstand the conditions of the test.

TABLE XI. TRANSIT DROP TEST

Weight of Test Item and Case (lb)	Largest Dimensions (in.)	Notes	Height of Drop (in.)	No. of Drops
Under 100 lb Man-packed and Man-portable	Under 36	A	48	Drop on each face, edge, and corner. Total of 26 drops
	36 and over	A	30	
100 to 200 lb Inclusive	Under 36	A	30	Drop on each corner
	36 and over	A	24	
Over 200 to 1,000 lb Inclusive	Under 36	A	24	Total of 8 drops
	36 to 60	B	36	
	Over 60	B	24	
Over 1,000	No limit	C	18	4 edgewise drops 2 cornerwise drops

Note A. Drops shall be made from a quick-release hook; or drop tester as made by the L. A. B. Corporation, Skaneateles, New York, or equal. The test item shall be oriented so that upon impact a line from the struck corner or edge to the center of gravity of the case and contents is perpendicular to the impact surface.

Note B. With the longest dimension parallel to the floor, the transit or combination case, with the test item within, shall be supported at the corner of one end by a block 5 in. in height, and at the other corner or edge of the same end by a block 12 in. in height. The opposite end of the case shall then be raised to the specified height at the lowest unsupported corner and allowed to fall freely.

Note C. While in the normal transit position, the case and contents shall be subjected to the edgewise and cornerwise drop test as follows (if normal transit position is unknown, the case shall be oriented such that the two longest dimensions are parallel to the "floor").

1. Edgewise Drop Test. One edge of the base of the case shall be supported on a sill 5 to 6 in. in height. The opposite edge shall be raised to the specified height and allowed to fall freely. The test shall be applied once to each edge of the base of the case (total of four drops).

2. Cornerwise Drop Test. One corner of the base of the case shall be supported on a block approximately 5 in. in height. A block normally 12 in. in height shall be placed under the other corner of the same end. The opposite end of the case shall be raised to the specified height at the lowest unsupported corner and allowed to fall freely. This test shall be applied once to each of two diagonally opposite corners of the base (total of two cornerwise drops). When the proportions of width and height of the case are such as to cause instability in the cornerwise drop test, edgewise drops shall be substituted. In such instances two more edgewise drops on each end shall be performed (four additional edgewise drops for a total of eight edgewise drops).

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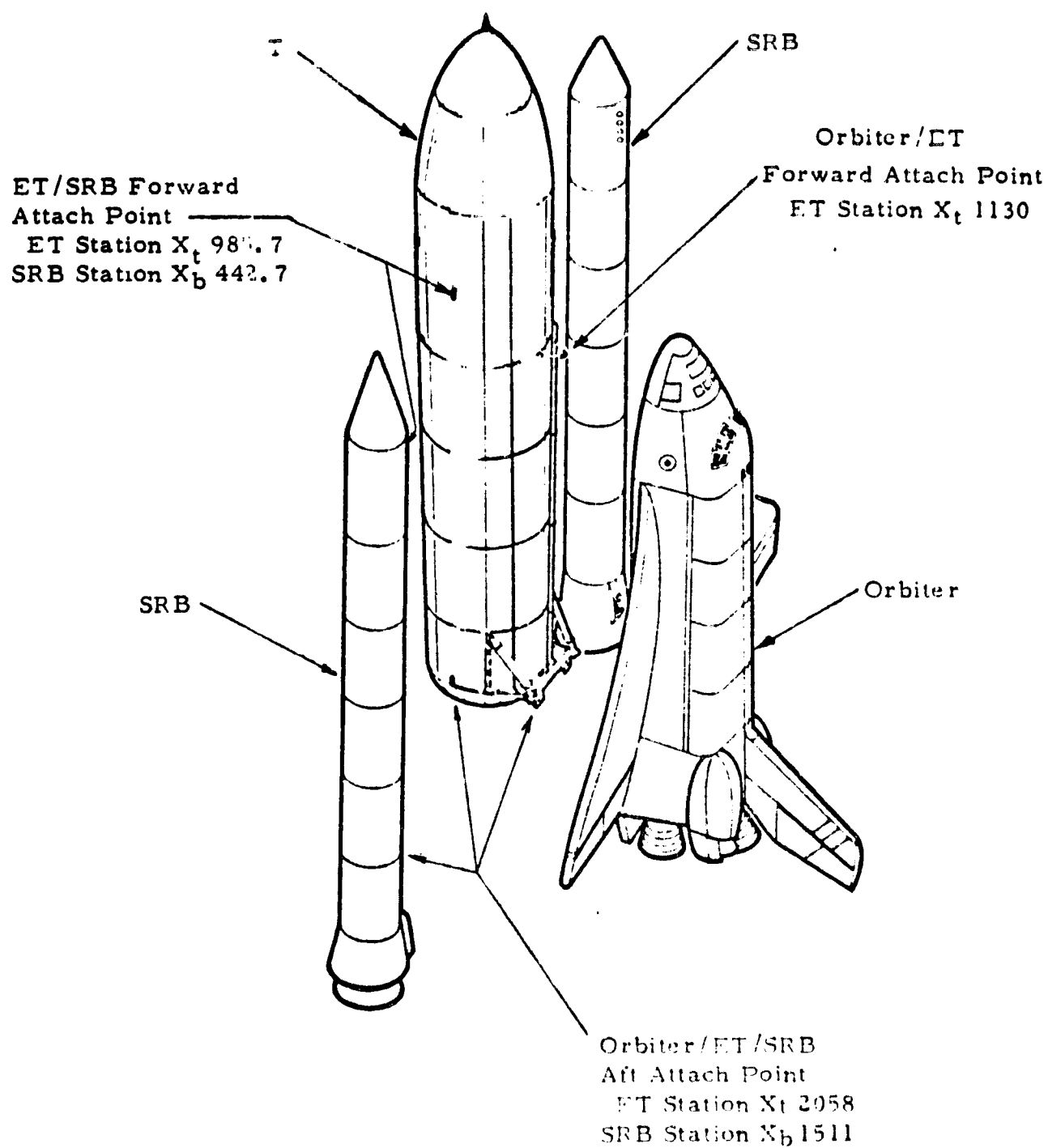


FIGURE 1. SPACE SHUTTLE GENERAL CONFIGURATION

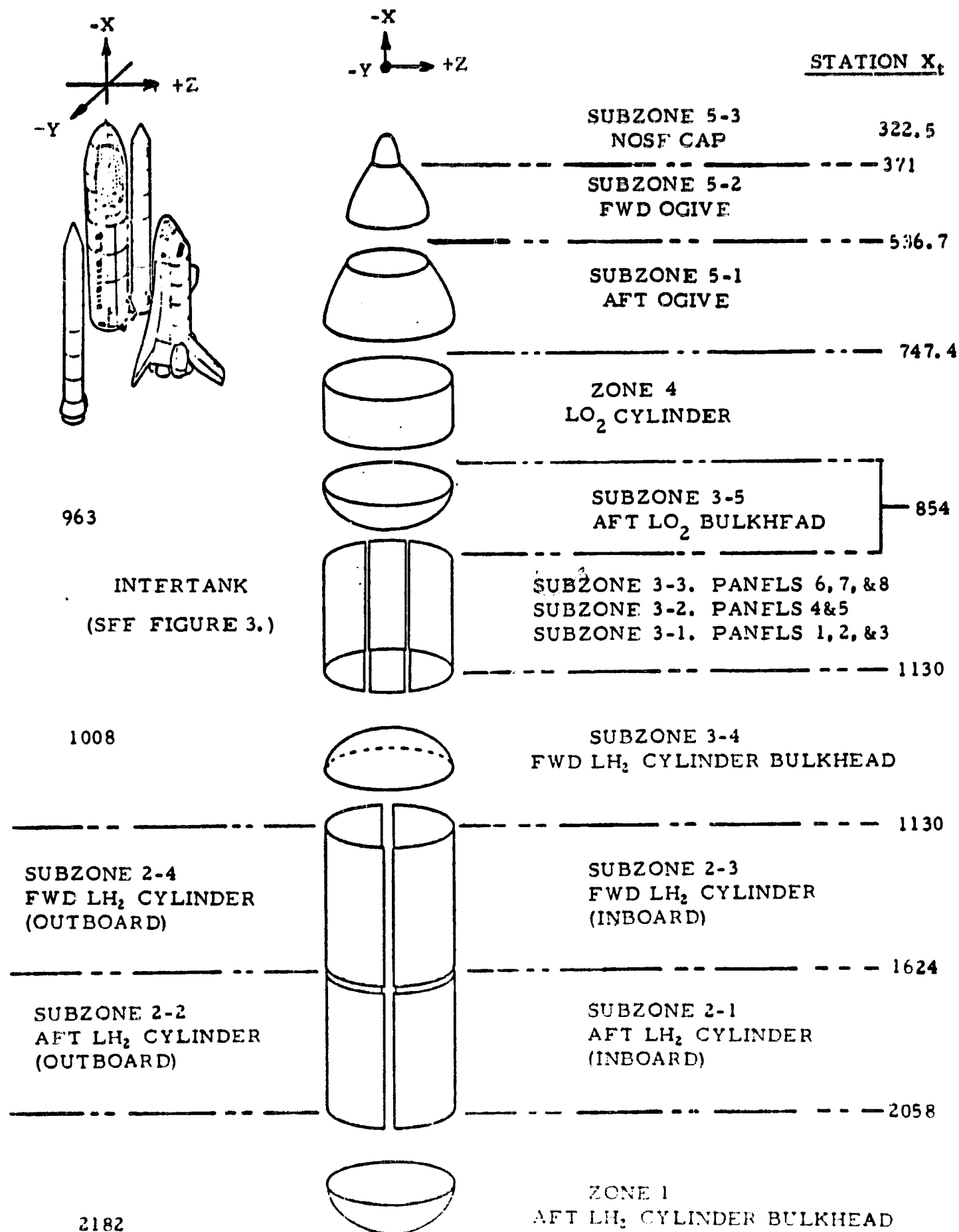


FIGURE 2. EXTERNAL TANK ZONES

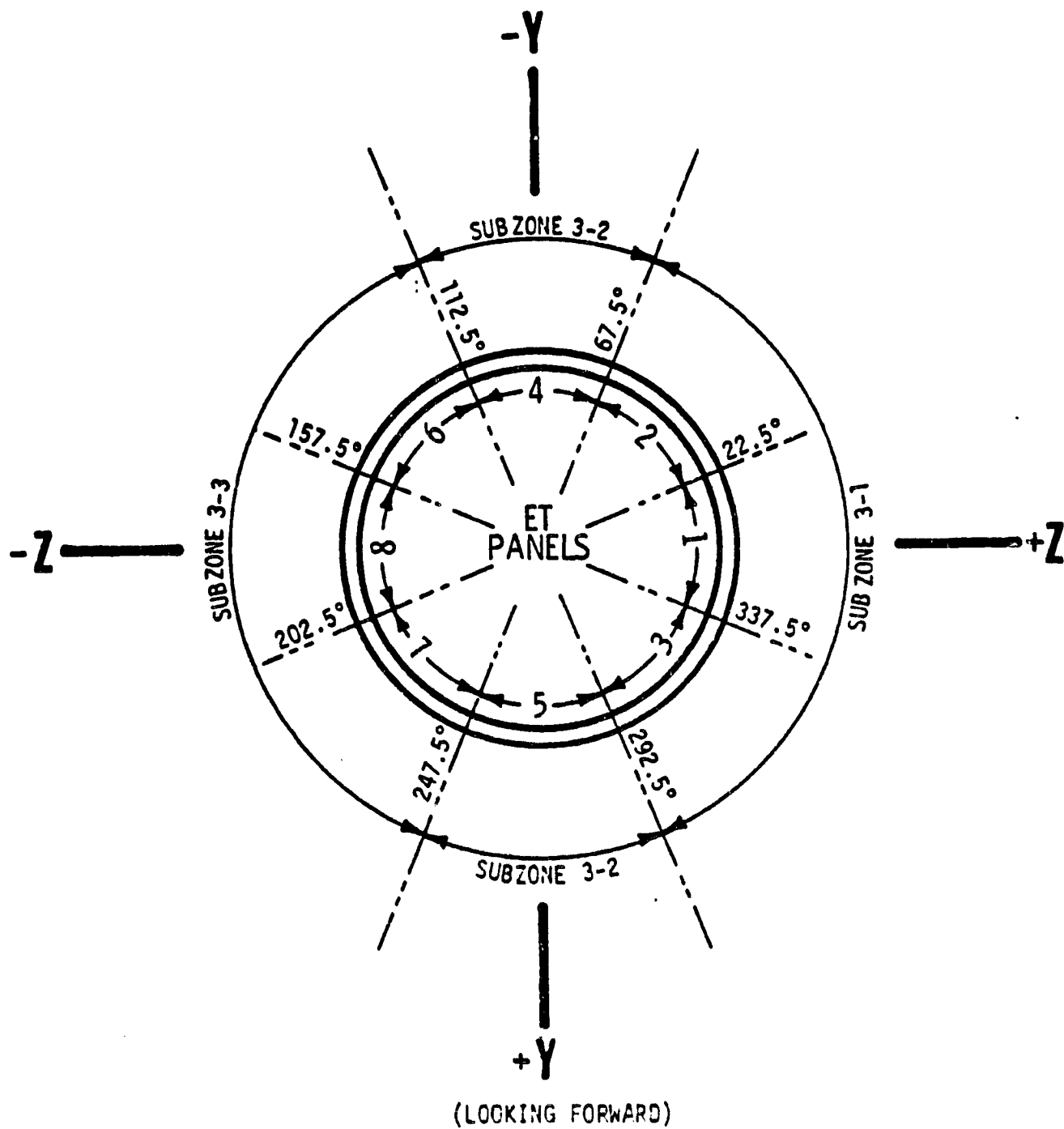


FIGURE 3. ET ZONE 3 SECTION

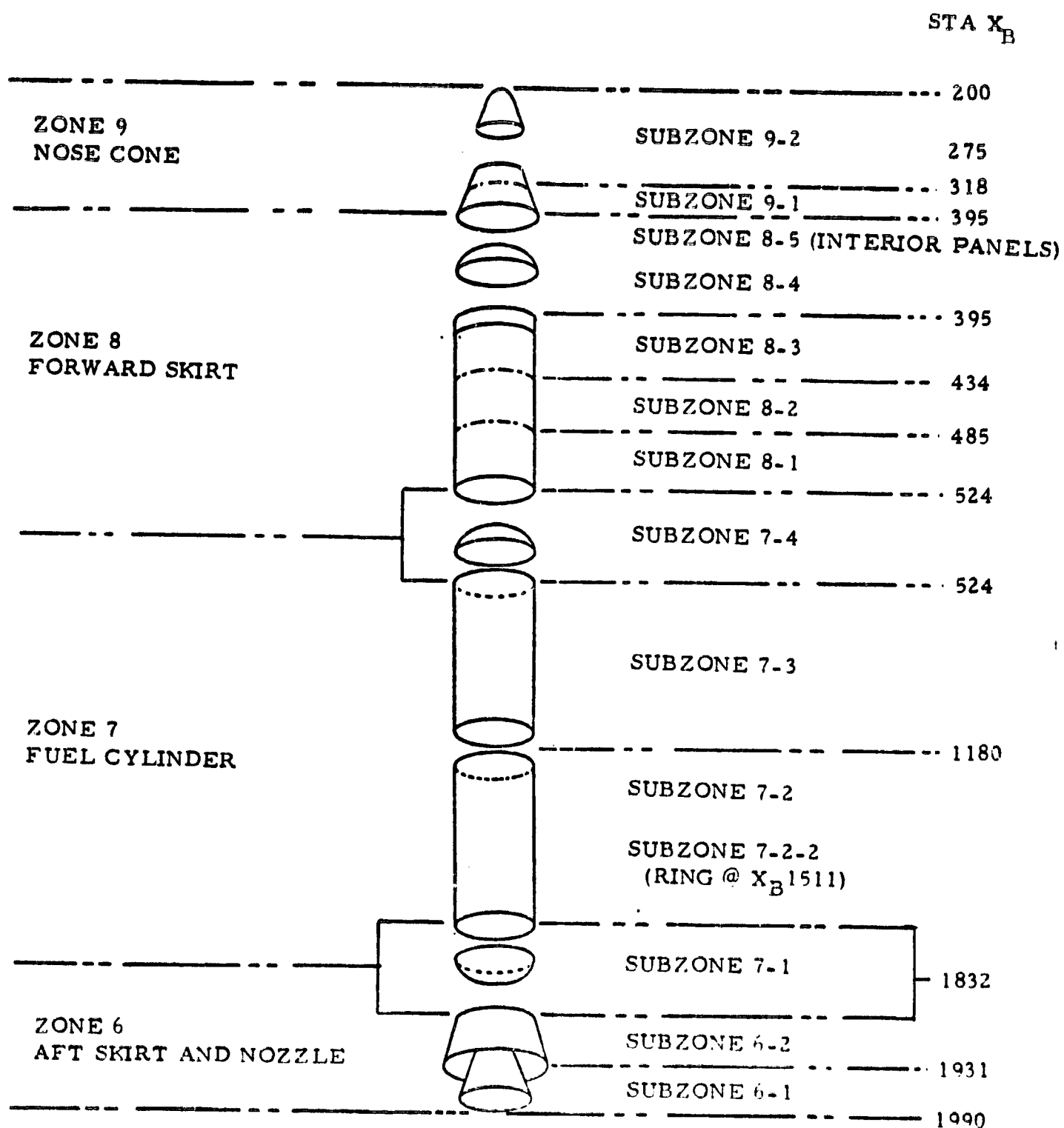


FIGURE 4. SOLID ROCKET BOOSTER ZONES

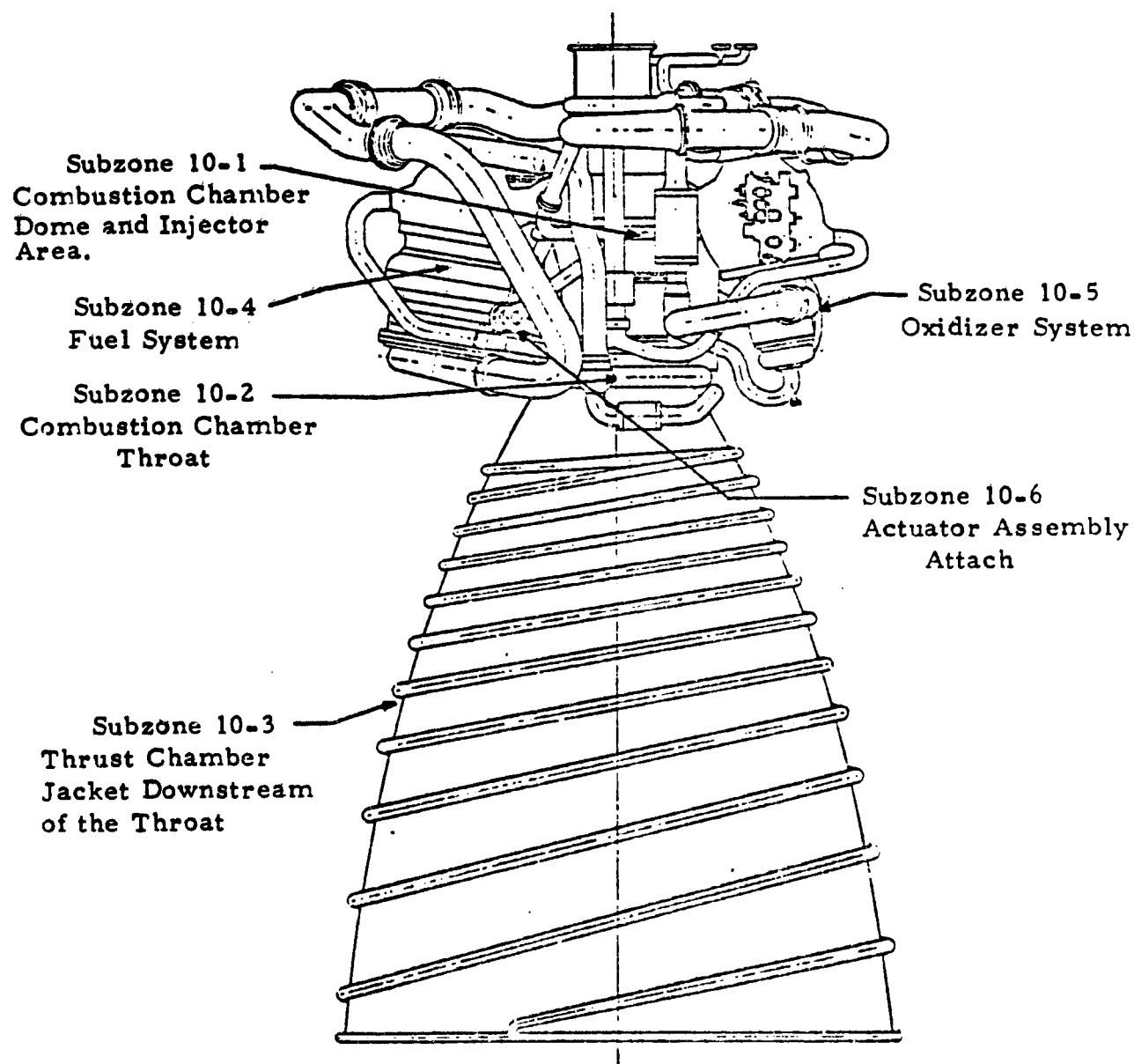


FIGURE 5. SSME SUBZONES

APPENDIX A
VIBRATION AND SHOCK CRITERIA
FOR
SPECIFIC COMPONENTS
OF THE
SPACE SHUTTLE EXTERNAL TANK

Input to ET Developmental Flight Instrumentation/Operational
Instrumentation (DFI/OI) Level Sensors (Sheet 1 of 2)

1. Acceptance Test Criteria

Radial Axis

20 - 80 Hz @ $0.23 \text{ g}^2/\text{Hz}$
80 - 100 Hz @ +6 dB/oct
100 - 140 Hz @ $0.37 \text{ g}^2/\text{Hz}$
140 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ $1.75 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.15 \text{ g}^2/\text{Hz}$

Composite = $38.2 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 33 Hz @ $0.016 \text{ g}^2/\text{Hz}$
33 - 80 Hz @ +10 dB/oct
80 - 120 Hz @ $0.37 \text{ g}^2/\text{Hz}$
120 - 160 Hz @ -10 dB/oct
160 - 650 Hz @ $0.12 \text{ g}^2/\text{Hz}$
650 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ $0.17 \text{ g}^2/\text{Hz}$
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.075 \text{ g}^2/\text{Hz}$

Composite = $16.9 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 25 Hz @ $0.12 \text{ g}^2/\text{Hz}$
25 - 115 Hz @ +6 dB/oct
115 - 400 Hz @ $2.80 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -4 dB/oct
2000 Hz @ $0.41 \text{ g}^2/\text{Hz}$

Composite = $42.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 33 Hz @ $0.065 \text{ g}^2/\text{Hz}$
33 - 80 Hz @ +10 dB/oct
80 - 120 Hz @ $1.50 \text{ g}^2/\text{Hz}$
120 - 160 Hz @ -10 dB/oct
160 - 650 Hz @ $0.50 \text{ g}^2/\text{Hz}$
650 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ $0.70 \text{ g}^2/\text{Hz}$
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.30 \text{ g}^2/\text{Hz}$

Composite = $33.9 \text{ g}_{\text{rms}}$

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Input to ET Developmental Flight Instrumentation/Operational
Instrumentation (DFI/OI) Level Sensors (Sheet 2 of 2)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 80 Hz @ $0.92 \text{ g}^2/\text{Hz}$
80 - 100 Hz @ +6 dB/oct
100 - 140 Hz @ $1.50 \text{ g}^2/\text{Hz}$
140 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ $7.00 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.62 \text{ g}^2/\text{Hz}$

Composite = $76.4 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.10 \text{ g}^2/\text{Hz}$
20 - 80 Hz @ +7 dB/oct
80 - 120 Hz @ $2.50 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ -10 dB/oct
180 - 900 Hz @ $0.50 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -4 dB/oct
2000 Hz @ $0.17 \text{ g}^2/\text{Hz}$

Composite = $31.1 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to the ET Operational Instrumentation
(OI) Ullage Temperature Probes (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0085 g^2 /Hz
20 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ 1.75 g^2 /Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 37.9 g_{rms}

Long. and Tang. Axes

20 - 30 Hz @ 0.012 g^2 /Hz
30 - 80 Hz @ +10 dB/oct
80 - 120 Hz @ 0.37 g^2 /Hz
120 - 160 Hz @ -10 dB/oct
160 - 2000 Hz @ 0.50 g^2 /Hz

Composite = 16.2 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 30 Hz @ 0.12 g^2 /Hz
30 - 140 Hz @ +6 dB/oct
140 - 400 Hz @ 2.80 g^2 /Hz
400 - 2000 Hz @ -4 dB/oct
2000 Hz @ 0.41 g^2 /Hz

Composite = 41.9 g_{rms}

Long. and Tang. Axes

20 - 30 Hz @ 0.050 g^2 /Hz
30 - 80 Hz @ +10 dB/oct
80 - 120 Hz @ 1.50 g^2 /Hz
120 - 160 Hz @ -10 dB/oct
160 - 2000 Hz @ 0.50 g^2 /Hz

Composite = 32.4 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.034 g^2 /Hz
20 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ 7.00 g^2 /Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.62 g^2 /Hz

Composite = 75.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.10 g^2 /Hz
20 - 80 Hz @ +7 dB/oct
80 - 120 Hz @ 2.50 g^2 /Hz
120 - 180 Hz @ -10 dB/oct
180 - 900 Hz @ 0.50 g^2 /Hz
900 - 2000 Hz @ -4 dB/oct
2000 Hz @ 0.17 g^2 /Hz

Composite = 31.1 g_{rms}

Input to the ET Operational Instrumentation
(OI) Ullage Temperature Probes (Sheet 2 of 2)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to the ET LH₂ Tank Instrumentation Islands (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 Hz @ 0.075 g^2 /Hz
20 - 130 Hz @ +6 dB/oct
130 - 270 Hz @ 3.00 g^2 /Hz
270 - 325 Hz @ -6 dB/oct
325 - 900 Hz @ 2.02 g^2 /Hz
900 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.41 g^2 /Hz

Composite = 53.5 g_{rms}

Directions B and C

20 Hz @ 0.017 g^2 /Hz
20 - 130 Hz @ +6 dB/oct
130 - 340 Hz @ 0.72 g^2 /Hz
340 - 430 Hz @ +6 dB/oct
430 - 1000 Hz @ 1.15 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.56 g^2 /Hz

Composite = 42.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 Hz @ 0.076 g^2 /Hz
20 - 110 Hz @ +9 dB/oct
110 - 300 Hz @ 12.50 g^2 /Hz
300 - 2000 Hz @ -3 dB/oct
2000 Hz @ 1.89 g^2 /Hz

Composite = 99.3 g_{rms}

Directions B and C

20 Hz @ 0.070 g^2 /Hz
20 - 130 Hz @ +6 dB/oct
130 - 340 Hz @ 2.90 g^2 /Hz
340 - 430 Hz @ +6 dB/oct
430 - 1000 Hz @ 4.60 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 2.30 g^2 /Hz

Composite = 83.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 Hz @ 0.30 g^2 /Hz
20 - 130 Hz @ +6 dB/oct
130 - 270 Hz @ 12.0 g^2 /Hz
270 - 325 Hz @ -6 dB/oct
325 - 900 Hz @ 8.10 g^2 /Hz
900 - 2000 Hz @ -6 dB/oct
2000 Hz @ 1.65 g^2 /Hz

Composite = 107.0 g_{rms}

Directions B and C

20 Hz @ 0.085 g^2 /Hz
20 - 90 Hz @ +6 dB/oct
90 - 150 Hz @ 1.70 g^2 /Hz
150 - 220 Hz @ -6 dB/oct
220 - 600 Hz @ 0.56 g^2 /Hz
600 - 670 Hz @ +10 dB/oct
670 - 1000 Hz @ 0.81 g^2 /Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.40 g^2 /Hz

Composite = 37.3 g_{rms}

Input to the ET LH₂ Tank Instrumentation Islands (Sheet 2 of 2)

4. Vehicle Dynamics Criteria

Longitudinal Axis

- 2 - 5 Hz @ 0.6 G's peak*
- 5 - 40 Hz @ 0.6 G's peak

Lateral Axes

- 2 - 6 Hz @ 1.4 G's peak
- 6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

- 50 Hz @ 24 G's peak
- 50 - 100 Hz @ +12 dB/oct
- 100 Hz @ 94 G's peak
- 100 - 4,000 Hz @ +6 dB/oct
- 4,000 - 10,000 Hz @ 3,750 G's peak

Direction A--Perpendicular to Mounting Surface

Direction B--Tangential to Mounting Surface

Direction C--Tangential to Mounting Surface, Perpendicular to
Direction B

* Design Criteria Only

Input to the ET Intertank Instrumentation Islands. (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.16 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 1.00 g^2 /Hz
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ 0.25 g^2 /Hz
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 1.00 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.16 g^2 /Hz

Composite = 31.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.045 g^2 /Hz
20 - 40 Hz @ +6 dB/oct
40 - 320 Hz @ 0.17 g^2 /Hz
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.032 g^2 /Hz

Composite = 20.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
20 - 110 Hz @ +6 dB/oct
110 - 350 Hz @ 0.30 g^2 /Hz
350 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 1.00 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.16 g^2 /Hz

Composite = 30.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2 /Hz
20 - 60 Hz @ +10 dB/oct
60 - 170 Hz @ 0.10 g^2 /Hz
170 - 300 Hz @ +9 dB/oct
300 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.094 g^2 /Hz

Composite = 23.0 g_{rms}

Input to the ET Intertank Instrumentation Islands. (Sheet 2 of 2)

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.64 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 4.00 g^2 /Hz
100 - 160 Hz @ -9 dB/oct
160 - 320 Hz @ 1.00 g^2 /Hz
320 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 4.00 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.64 g^2 /Hz

Composite = 63.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.18 g^2 /Hz
20 - 40 Hz @ +6 dB/oct
40 - 320 Hz @ 0.70 g^2 /Hz
320 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ 2.00 g^2 /Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.13 g^2 /Hz

Composite = 41.7 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

50 Hz @ 94 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 375 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 15,000 G's peak

* Design Criteria Only

Input to the ET LO₂ Tank Instrumentation Islands (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Direction A

20 - 80 Hz @ 0.23 g²/Hz
80 - 100 Hz @ +6 dB/oct
100 - 140 Hz @ 0.37 g²/Hz
140 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ 1.75 g²/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.15 g²/Hz

Composite = 38.2 g_{rms}

Directions B and C

20 Hz @ 0.00052 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 1000 Hz @ 0.070 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.035 g²/Hz

Composite = 10.6 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Direction A

20 - 40 Hz @ 0.12 g²/Hz
40 - 80 Hz @ +6 dB/oct
80 - 150 Hz @ 0.40 g²/Hz
150 - 300 Hz @ +6 dB/oct
300 - 500 Hz @ 1.60 g²/Hz
500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.41 g²/Hz

Composite = 40.2 g_{rms}

Directions B and C

20 Hz @ 0.0032 g²/Hz
20 - 100 Hz @ +6 dB/oct
100 - 680 Hz @ 0.080 g²/Hz
680 - 700 Hz @ +9 dB/oct
700 - 1000 Hz @ 0.092 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.046 g²/Hz

Composite = 12.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Direction A

20 - 80 Hz @ 0.92 g²/Hz
80 - 100 Hz @ +6 dB/oct
100 - 140 Hz @ 1.50 g²/Hz
140 - 300 Hz @ +6 dB/oct
300 - 600 Hz @ 7.00 g²/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.62 g²/Hz

Composite = 76.4 g_{rms}

Directions B and C

20 Hz @ 0.0021 g²/Hz
20 - 100 Hz @ +9 dB/oct
100 - 1000 Hz @ 0.28 g²/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.14 g²/Hz

Composite = 21.3 g_{rms}

Input to the ET LO₂ Tank Instrumentation Islands (Sheet 2 of 2)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 6 Hz @ 1.4 G's peak*
6 - 40 Hz @ 1.4 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

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Input to Components Mounted on the ET/Orbiter Forward Attach Strut
(Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0072 g^2 /Hz
 20 - 130 Hz @ +4 dB/oct
 130 - 1500 Hz @ 0.087 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.047 g^2 /Hz

Composite = 12.5 g_{rms}

Long and Tang. Axes

20 Hz @ 0.0060 g^2 /Hz
 20 - 700 Hz @ +3 dB/oct
 700 - 1500 Hz @ 0.20 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.12 g^2 /Hz

Composite = 16.8 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.11 g^2 /Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 200 Hz @ 0.090 g^2 /Hz
 200 - 250 Hz @ -9 dB/oct
 250 - 1400 Hz @ 0.045 g^2 /Hz
 1400 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.015 g^2 /Hz

Composite = 9.1 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.016 g^2 /Hz
 50 - 1000 Hz @ +2 dB/oct
 1000 - 1400 Hz @ 0.13 g^2 /Hz
 1400 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.065 g^2 /Hz

Composite = 13.5 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.029 g^2 /Hz
 20 - 130 Hz @ +4 dB/oct
 130 - 1500 Hz @ 0.35 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.19 g^2 /Hz

Composite = 25.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.024 g^2 /Hz
 20 - 700 Hz @ +3 dB/oct
 700 - 1500 Hz @ 0.80 g^2 /Hz
 1500 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.50 g^2 /Hz

Composite = 33.6 g_{rms}

Input to Components Mounted on the ET/Orbiter Forward Attach Strut
(Sheet 2 of 2)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

See Table I

* Design Criteria Only

Input to Components Mounted on the ET/Orbiter Aft Attach Struts
(Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0019 g^2 /Hz
20 - 100 Hz @ +4 dB/oct
100 - 1100 Hz @ 0.016 g^2 /Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0025 g^2 /Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.035 g^2 /Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.015 g^2 /Hz

Composite = 6.9 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0077 g^2 /Hz
20 - 100 Hz @ +4 dB/oct
100 - 1100 Hz @ 0.065 g^2 /Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2 /Hz

Composite = 10.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0098 g^2 /Hz
20 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.14 g^2 /Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.059 g^2 /Hz

Composite = 13.9 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0014 g^2 /Hz
20 - 100 Hz @ +6 dB/oct
100 - 200 Hz @ 0.035 g^2 /Hz
200 - 350 Hz @ -6 dB/oct
350 - 1500 Hz @ 0.012 g^2 /Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0049 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 70 Hz @ 0.0025 g^2 /Hz
70 - 110 Hz @ +9 dB/oct
110 - 800 Hz @ 0.010 g^2 /Hz
800 - 1000 Hz @ +6 dB/oct
1000 - 1500 Hz @ 0.017 g^2 /Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0094 g^2 /Hz

Composite = 5.0 g_{rms}

Input to Components Mounted on the ET/Orbiter Aft Attach Struts
(Sheet 2 of 2)

4. Vehicle Dynamics Criteria

Longitudinal Axis

2 - 5 Hz @ 0.6 G's peak*
5 - 40 Hz @ 0.6 G's peak

Lateral Axes

2 - 5 Hz @ 0.8 G's peak*
5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to Components Mounted on the ET/Orbiter Aft Attach Crossbeam
(Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.00035 g^2 /Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 200 Hz @ 0.0087 g^2 /Hz
 200 - 350 Hz @ -6 dB/oct
 350 - 1500 Hz @ 0.0030 g^2 /Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0012 g^2 /Hz

Composite = 2.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00032 g^2 /Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.0045 g^2 /Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0019 g^2 /Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0019 g^2 /Hz
 20 - 100 Hz @ +4 dB/oct
 100 - 1100 Hz @ 0.016 g^2 /Hz
 1100 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.0050 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0013 g^2 /Hz
 20 - 1100 Hz @ +2 dB/oct
 1100 - 1500 Hz @ 0.018 g^2 /Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0076 g^2 /Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0014 g^2 /Hz
 20 - 100 Hz @ +6 dB/oct
 100 - 200 Hz @ 0.035 g^2 /Hz
 200 - 350 Hz @ -6 dB/oct
 350 - 1500 Hz @ 0.012 g^2 /Hz
 1500 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.0049 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 70 Hz @ 0.0025 g^2 /Hz
 70 - 110 Hz @ +9 dB/oct
 110 - 800 Hz @ 0.010 g^2 /Hz
 800 - 1000 Hz @ +6 dB/oct
 1000 - 1500 Hz @ 0.017 g^2 /Hz
 1500 - 2000 Hz @ - dB/oct
 2000 Hz @ 0.0094 g^2 /Hz

Composite = 5.0 g_{rms}

Input to Components Mounted on the ET/Orbiter Aft Attach Crossbeam
(Sheet 2 of 2)

4. Vehicle Dynamics Criteria

Longitudinal Axis

Lateral Axes

2 - 5 Hz @ 0.6 G's peak*

2 - 5 Hz @ 0.8 G's peak*

5 - 40 Hz @ 0.6 G's peak

5 - 40 Hz @ 0.8 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

APPENDIX B
VIBRATION AND SHOCK CRITERIA
FOR
SPECIFIC COMPONENTS
OF THE
SPACE SHUTTLE SOLID ROCKET BOOSTER

Input to the Range Safety Panels. Total Weight of Components
On the Panel = 20 lb. (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 250 Hz @ 0.10 g^2/Hz
250 - 500 Hz @ -9 dB/oct
500 - 1200 Hz @ 0.012 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0030 g^2/Hz

Composite = 6.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0088 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 105 Hz @ 0.017 g^2/Hz
105 - 300 Hz @ +3 dB/oct
300 - 400 Hz @ 0.050 g^2/Hz
400 - 500 Hz @ -15 dB/oct
500 - 630 Hz @ 0.015 g^2/Hz
630 - 800 Hz @ +15 dB/oct
800 - 1000 Hz @ 0.050 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 7.6 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 110 Hz @ +3 dB/oct
110 - 250 Hz @ 0.20 g^2/Hz
250 - 470 Hz @ -9 dB/oct
470 - 1000 Hz @ 0.030 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0075 g^2/Hz

Composite = 9.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.050 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 360 Hz @ 0.10 g^2/Hz
360 - 460 Hz @ -15 dB/oct
460 - 630 Hz @ 0.030 g^2/Hz
630 - 800 Hz @ +15 dB/oct
800 - 1000 Hz @ 0.10 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 11.2 g_{rms}

Input to the Range Safety Panels. Total Weight of Components
On the Panel = 20 lb. (Sheet 2 of 3)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 250 Hz @ 0.40 g^2/Hz
250 - 500 Hz @ -9 dB/oct
500 - 1200 Hz @ 0.050 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 12.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.035 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 105 Hz @ 0.070 g^2/Hz
105 - 300 Hz @ +3 dB/oct
300 - 400 Hz @ 0.20 g^2/Hz
400 - 500 Hz @ -15 dB/oct
500 - 630 Hz @ 0.060 g^2/Hz
630 - 800 Hz @ +15 dB/oct
800 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.050 g^2/Hz

Composite = 15.2 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.38 g^2/Hz
20 - 36 Hz @ +3 dB/oct
36 - 60 Hz @ 0.64 g^2/Hz
60 - 70 Hz @ -9 dB/oct
70 - 250 Hz @ 0.44 g^2/Hz
250 - 550 Hz @ -12 dB/oct
550 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 12.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.54 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 50 Hz @ 0.90 g^2/Hz
50 - 80 Hz @ -12 dB/oct
80 - 360 Hz @ 0.15 g^2/Hz
360 - 450 Hz @ -15 dB/oct
450 - 700 Hz @ 0.050 g^2/Hz
700 - 760 Hz @ +15 dB/oct
760 - 900 Hz @ 0.075 g^2/Hz
900 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.034 g^2/Hz

Composite = 12.9 g_{rms}

Input to the Range Safety Panels. Total Weight of Components
On the Panel = 20 lb. (Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to Components on the Range Safety Panels. Total Weight
Of Components on the Panel = 20 lb. (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.095 g^2/Hz
20 - 70 Hz @ +3 dB/oct
70 - 90 Hz @ 0.30 g^2/Hz
90 - 115 Hz @ -12 dB/oct
115 - 250 Hz @ 0.11 g^2/Hz
250 - 550 Hz @ -12 dB/oct
550 - 1000 Hz @ 0.0050 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0013 g^2/Hz

Composite = 6.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0087 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 105 Hz @ 0.017 g^2/Hz
105 - 300 Hz @ +3 dB/oct
300 - 1000 Hz @ 0.050 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0012 g^2/Hz

Composite = 8.2 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 250 Hz @ 0.20 g^2/Hz
250 - 470 Hz @ -9 dB/oct
470 - 1000 Hz @ 0.030 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0075 g^2/Hz

Composite = 9.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.050 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 1000 Hz @ 0.10 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 12.1 g_{rms}

Input to Components on the Range Safety Panels. Total Weight
Of Components on the Panel = 20 lb. (Sheet 2 of 3)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.20 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 250 Hz @ 0.40 g^2/Hz
250 - 500 Hz @ -9 dB/oct
500 - 1200 Hz @ 0.050 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 13.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.035 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 105 Hz @ 0.070 g^2/Hz
105 - 300 Hz @ +3 dB/oct
300 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.050 g^2/Hz

Composite = 16.4 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.38 g^2/Hz
20 - 70 Hz @ +3 dB/oct
70 - 90 Hz @ 1.20 g^2/Hz
90 - 115 Hz @ -12 dB/oct
115 - 250 Hz @ 0.44 g^2/Hz
250 - 550 Hz @ -12 dB/oct
550 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 13.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.54 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 50 Hz @ 0.90 g^2/Hz
50 - 80 Hz @ -12 dB/oct
80 - 450 Hz @ 0.15 g^2/Hz
450 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.034 g^2/Hz

Composite = 13.8 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to Components on the Range Safety Panels. Total Weight
Of Components on the Panel = 20 lb. (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Range Safety Panels. Total Weight of Components
On the Panel = 55 lb. (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 50 Hz @ 0.12 g^2 /Hz
50 - 56 Hz @ -9 dB/oct
56 - 230 Hz @ 0.090 g^2 /Hz
230 - 500 Hz @ -12 dB/oct
500 - 1000 Hz @ 0.0042 g^2 /Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0010 g^2 /Hz

Composite = 5.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0070 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 95 Hz @ 0.014 g^2 /Hz
95 - 250 Hz @ +3 dB/oct
250 - 320 Hz @ 0.037 g^2 /Hz
320 - 400 Hz @ -15 dB/oct
400 - 560 Hz @ 0.012 g^2 /Hz
560 - 700 Hz @ +15 dB/oct
700 - 1000 Hz @ 0.037 g^2 /Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0095 g^2 /Hz

Composite = 6.6 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.031 g^2 /Hz
20 - 100 Hz @ +3 dB/oct
100 - 250 Hz @ 0.15 g^2 /Hz
250 - 470 Hz @ -9 dB/oct
470 - 1000 Hz @ 0.023 g^2 /Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0058 g^2 /Hz

Composite = 8.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.040 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 340 Hz @ 0.080 g^2 /Hz
340 - 420 Hz @ -15 dB/oct
420 - 560 Hz @ 0.025 g^2 /Hz
560 - 700 Hz @ +15 dB/oct
700 - 1000 Hz @ 0.080 g^2 /Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2 /Hz

Composite = 10.2 g_{rms}

Input to the Range Safety Panels. Total Weight of Components
On the Panel = 55 lb. (Sheet 2 of 3)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.038 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 250 Hz @ 0.28 g^2/Hz
250 - 480 Hz @ -9 dB/oct
480 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 10.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.028 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 95 Hz @ 0.056 g^2/Hz
95 - 250 Hz @ +3 dB/oct
250 - 320 Hz @ 0.15 g^2/Hz
320 - 400 Hz @ -15 dB/oct
400 - 560 Hz @ 0.050 g^2/Hz
560 - 700 Hz @ +15 dB/oct
700 - 1000 Hz @ 0.15 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 13.3 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 50 Hz @ 0.50 g^2/Hz
50 - 56 Hz @ -9 dB/oct
56 - 230 Hz @ 0.36 g^2/Hz
230 - 500 Hz @ -12 dB/oct
500 - 1000 Hz @ 0.017 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0042 g^2/Hz

Composite = 11.0 g_{rms}

Long. and Tang. Axes

20 - 40 Hz @ 0.75 g^2/Hz
40 - 60 Hz @ -12 dB/oct
60 - 320 Hz @ 0.13 g^2/Hz
320 - 400 Hz @ -15 dB/oct
400 - 600 Hz @ 0.040 g^2/Hz
600 - 650 Hz @ +15 dB/oct
650 - 800 Hz @ 0.065 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.026 g^2/Hz

Composite = 11.4 g_{rms}

Input to the Range Safety Panels. Total Weight of Components
On the Panel = 55 lb. (Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to Components on the Range Safety Panels. Total Weight
Of Components on the Panel = 55 lb. (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.12 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 0.25 g^2/Hz
60 - 75 Hz @ -12 dB/oct
75 - 230 Hz @ 0.090 g^2/Hz
230 - 500 Hz @ -12 dB/oct
500 - 1000 Hz @ 0.0042 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0010 g^2/Hz

Composite = 5.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0070 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 95 Hz @ 0.014 g^2/Hz
95 - 250 Hz @ +3 dB/oct
250 - 1000 Hz @ 0.037 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0095 g^2/Hz

Composite = 7.2 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.075 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 250 Hz @ 0.15 g^2/Hz
250 - 470 Hz @ -9 dB/oct
470 - 1000 Hz @ 0.023 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 8.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.040 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 1000 Hz @ 0.080 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2/Hz

Composite = 10.9 g_{rms}

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Input to Components on the Range Safety Panels. Total Weight
Of Components on the Panel = 55 lb. (Sheet 2 of 3)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.14 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 250 Hz @ 0.28 g^2/Hz
250 - 480 Hz @ -9 dB/oct
480 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 11.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.028 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 95 Hz @ 0.056 g^2/Hz
95 - 250 Hz @ +3 dB/oct
250 - 1000 Hz @ 0.15 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 14.4 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.50 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 1.00 g^2/Hz
60 - 75 Hz @ -12 dB/oct
75 - 230 Hz @ 0.36 g^2/Hz
230 - 500 Hz @ -12 dB/oct
500 - 1000 Hz @ 0.017 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0042 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 - 40 Hz @ 0.75 g^2/Hz
40 - 60 Hz @ -12 dB/oct
60 - 400 Hz @ 0.13 g^2/Hz
400 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.026 g^2/Hz

Composite = 12.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to Components on the Range Safety Panels. Total Weight
Of Components on the Panel = 55 lb. (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Range Safety System Linear Shaped Charge (LSC)
(Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0090 g^2/Hz
20 - 180 Hz @ +6 dB/oct
180 - 280 Hz @ 0.78 g^2/Hz
280 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 17.6 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.0050 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.015 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 3.2 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 - 50 Hz @ 0.020 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.060 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 180 Hz @ +6 dB/oct
180 - 280 Hz @ 3.13 g^2/Hz
280 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.059 g^2/Hz

Composite = 35.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0039 g^2/Hz
20 - 80 Hz @ +6 dB/oct
80 - 275 Hz @ 0.063 g^2/Hz
275 - 560 Hz @ -9 dB/oct
560 - 2000 Hz @ 0.0075 g^2/Hz

Composite = 5.6 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.60 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the Range Safety System Linear Shaped Charge (LSC)
(Sheet 2 of 2)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance Shock

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
7 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
1.7 G's peak Amplitude
300 msec Duration

**Input to the Linear Shaped Charge (LSC) Assembly and the Detonator
Block Located at the Forward Skirt/Frustum Separation Plane
(Sheet 1 of 3)**

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g²/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 0.32 g²/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.014 g²/Hz

Composite = 15.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g²/Hz
20 - 150 Hz @ +3 dB/oct
150 - 1000 Hz @ 0.12 g²/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.015 g²/Hz

Composite = 12.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0054 g²/Hz
20 - 150 Hz @ +3 dB/oct
150 - 320 Hz @ 0.040 g²/Hz
320 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.065 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0042 g²/Hz

Composite = 7.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.010 g²/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.050 g²/Hz
150 - 190 Hz @ -6 dB/oct
190 - 1000 Hz @ 0.030 g²/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0075 g²/Hz

Composite = 6.8 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0071 g²/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.14 g²/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0090 g²/Hz

Composite = 11.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g²/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.060 g²/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.015 g²/Hz

Composite = 9.3 g_{rms}

Input to the Linear Shaped Charge (LSC) Assembly and the Detonator
Block Located at the Forward Skirt/Frustum Separation Plane
(Sheet 2 of 3)

4. Reentry Random Vibration Criteria (90 sec/axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 1.30 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.056 g^2/Hz

Composite = 31.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.064 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 1000 Hz @ 0.48 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.060 g^2/Hz

Composite = 25.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the Linear Shaped Charge (LSC) Assembly and the Detonator
Block Located at the Forward Skirt/Frustum Separation Plane
(Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

SRB/ET Separation

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

Input to the Confined Detonating Fuse (CDF) Initiators,
CDF Assembly and CDF Manifold (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 30 Hz @ 0.20 g^2/Hz
30 - 50 Hz @ +3 dB/oct
50 - 200 Hz @ 0.33 g^2/Hz
200 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 0.85 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 25.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.20 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 0.40 g^2/Hz
60 - 65 Hz @ -12 dB/oct
65 - 1000 Hz @ 0.30 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 20.2 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 34 Hz @ +6 dB/oct
34 - 83 Hz @ 0.15 g^2/Hz
83 - 200 Hz @ +3 dB/oct
200 - 400 Hz @ 0.36 g^2/Hz
400 - 500 Hz @ -9 dB/oct
500 - 800 Hz @ 0.18 g^2/Hz
800 - 1225 Hz @ -9 dB/oct
1225 - 1500 Hz @ 0.050 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 16.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.056 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 340 Hz @ 0.14 g^2/Hz
340 - 400 Hz @ +6 dB/oct
400 - 1200 Hz @ 0.19 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.11 g^2/Hz

Composite = 17.9 g_{rms}

Input to the Confined Detonating Fuse (CDF) Initiators,
CDF Assembly and CDF Manifold (Sheet 2 of 3)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 25 Hz @ 0.12 g²/Hz
 25 - 36 Hz @ +6 dB/oct
 36 - 100 Hz @ 0.28 g²/Hz
 100 - 250 Hz @ +3 dB/oct
 250 - 400 Hz @ 0.70 g²/Hz
 400 - 495 Hz @ -9 dB/oct
 495 - 800 Hz @ 0.38 g²/Hz
 800 - 1250 Hz @ -9 dB/oct
 1250 - 1500 Hz @ 0.10 g²/Hz
 1500 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.075 g²/Hz

Composite = 22.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.048 g²/Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 75 Hz @ 0.12 g²/Hz
 75 - 100 Hz @ +3 dB/oct
 100 - 174 Hz @ 0.16 g²/Hz
 174 - 390 Hz @ +3 dB/oct
 390 - 1200 Hz @ 0.36 g²/Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.22 g²/Hz

Composite = 24.3 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 30 Hz @ 0.80 g²/Hz
 30 - 50 Hz @ +3 dB/oct
 50 - 200 Hz @ 1.30 g²/Hz
 200 - 500 Hz @ +3 dB/oct
 500 - 700 Hz @ 3.40 g²/Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g²/Hz

Composite = 51.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.80 g²/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 1.60 g²/Hz
 60 - 65 Hz @ -12 dB/oct
 65 - 1000 Hz @ 1.20 g²/Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g²/Hz

Composite = 40.5 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
 5 - 10 Hz @ 0.6 G's peak
 10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the Confined Detonating Fuse (CDF) Initiators,
CDF Assembly and CDF Manifold (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance Shock

50 Hz @ 47 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 188 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 7,500 G's peak

B. Water Landing

Longitudinal Axis

Lateral Axes

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Lateral Axes

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

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Input to the NSI Detonator (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.050 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 220 Hz @ 0.10 g^2 /Hz
220 - 600 Hz @ +6 dB/oct
600 - 1000 Hz @ 0.75 g^2 /Hz
1000 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 28.3 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 Hz @ 0.20 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 220 Hz @ 0.40 g^2 /Hz
220 - 600 Hz @ +6 dB/oct
600 - 1000 Hz @ 3.00 g^2 /Hz
1000 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.60 g^2 /Hz

Composite = 56.6 g_{rms}

Input to the NSI Detonator (Sheet 2 of 3)

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.38 g^2 /Hz
20 - 70 Hz @ +3 dB/oct
70 - 90 Hz @ 1.20 g^2 /Hz
90 - 97 Hz @ -12 dB/oct
97 - 130 Hz @ 0.90 g^2 /Hz
130 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 3.40 g^2 /Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 51.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.54 g^2 /Hz
20 - 34 Hz @ +3 dB/oct
34 - 50 Hz @ 0.90 g^2 /Hz
50 - 54 Hz @ -12 dB/oct
54 - 70 Hz @ 0.70 g^2 /Hz
70 - 120 Hz @ +3 dB/oct
120 - 1000 Hz @ 1.20 g^2 /Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 40.0 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the NSI Detonator (Sheet 3 of 3)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance Shock

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Nose Cap Separation Thrusters and Pressure Cartridges
(Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axes

20 - 50 Hz @ 0.032 g^2 /Hz
50 - 60 Hz @ -6 dB/oct
60 - 400 Hz @ 0.022 g^2 /Hz
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00018 g^2 /Hz

Composite = 3.6 g_{rms}

Long. and Tang. Axes

20 - 150 Hz @ 0.014 g^2 /Hz
150 - 240 Hz @ -9 dB/oct
240 - 1000 Hz @ 0.0032 g^2 /Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00042 g^2 /Hz

Composite = 2.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 - 800 Hz @ 0.024 g^2 /Hz
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00064 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 1100 Hz @ 0.018 g^2 /Hz
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0019 g^2 /Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 120 Hz @ 0.0080 g^2 /Hz
120 - 180 Hz @ +9 dB/oct
180 - 800 Hz @ 0.027 g^2 /Hz
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00068 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 120 Hz @ 0.0056 g^2 /Hz
120 - 180 Hz @ +9 dB/oct
180 - 1100 Hz @ 0.019 g^2 /Hz
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0018 g^2 /Hz

Composite = 5.0 g_{rms}

Input to the Nose Cap Separation Thrusters and Pressure Cartridges
(Sheet 2 of 2)

4. Reentry Random Vibration Criteria (90 sec/axis)

Radial Axis

20 - 50 Hz @ 0.13 g^2 /Hz
50 - 60 Hz @ -6 dB/oct
60 - 400 Hz @ 0.090 g^2 /Hz
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00073 g^2 /Hz

Composite = 7.3 g_{rms}

Long. and Tang. Axes

20 - 150 Hz @ 0.022 g^2 /Hz
150 - 240 Hz @ -9 dB/oct
240 - 1000 Hz @ 0.013 g^2 /Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0017 g^2 /Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to the SRB Separation Motors (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.033 g^2/Hz
20 - 31 Hz @ +6 dB/oct
31 - 225 Hz @ 0.11 g^2/Hz
225 - 385 Hz @ -9 dB/oct
385 - 800 Hz @ 0.023 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0035 g^2/Hz

Composite = 7.1 g_{rms}

Long. and Tang. Axes

20 - 34 Hz @ 0.010 g^2/Hz
34 - 90 Hz @ +6 dB/oct
90 - 800 Hz @ 0.075 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 9.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.017 g^2/Hz
20 - 32 Hz @ +3 dB/oct
32 Hz @ 0.026 g^2/Hz
32 - 55 Hz @ +6 dB/oct
55 - 200 Hz @ 0.077 g^2/Hz
200 - 270 Hz @ -12 dB/oct
270 - 800 Hz @ 0.023 g^2/Hz
800 - 845 Hz @ -12 dB/oct
845 - 1200 Hz @ 0.019 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 6.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 75 Hz @ +3 dB/oct
75 - 1000 Hz @ 0.060 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.030 g^2/Hz

Composite = 10.0 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 - 200 Hz @ 0.12 g^2/Hz
200 - 265 Hz @ -12 dB/oct
265 - 800 Hz @ 0.039 g^2/Hz
800 - 1100 Hz @ -12 dB/oct
1100 Hz @ 0.011 g^2/Hz
1100 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0060 g^2/Hz

Composite = 7.8 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.054 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.022 g^2/Hz

Composite = 9.0 g_{rms}

Input to the SRB Separation Motors (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (90 sec/axis)

Radial Axis

20 Hz @ 0.13 g^2/Hz
20 - 31 Hz @ +6 dB/oct
31 - 225 Hz @ 0.45 g^2/Hz
225 - 385 Hz @ -9 dB/oct
385 - 800 Hz @ 0.090 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.014 g^2/Hz

Composite = 14.3 g_{rms}

Long. and Tang. Axes

20 - 34 Hz @ 0.040 g^2/Hz
34 - 90 Hz @ +6 dB/oct
90 - 800 Hz @ 0.30 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.048 g^2/Hz

Composite = 19.1 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the SRB Separation Motors (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordinance

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Lateral Axes

Half Sine Pulse

Half Sine Pulse

50 G's peak Amplitude

27 G's peak Amplitude

50 msec Duration

100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Lateral Axes

Half Sine Pulse

Half Sine Pulse

3.1 G's peak Amplitude

8.1 G's peak Amplitude

300 msec Duration

300 msec Duration

Input to the SRB/FT Aft Attach Point Separation Bolt (Sheet 1 of 1)

1. Acceptance Test Criteria (1 min/axis)

20 - 40 Hz @ 0.0050 g^2/Hz
40 - 100 Hz @ +4 dB/oct
100 - 350 Hz @ 0.016 g^2/Hz
350 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.035 g^2/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 7.0 g_{rms}

2. Flight Random Vibration Criteria (6 min/axis)

20 - 40 Hz @ 0.020 g^2/Hz
40 - 100 Hz @ +4 dB/oct
100 - 350 Hz @ 0.065 g^2/Hz
350 - 1100 Hz @ +2 dB/oct
1100 - 1500 Hz @ 0.14 g^2/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.059 g^2/Hz

Composite = 14.1 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

N/A

4. Vehicle Dynamics Criteria

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 1.0 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to the SRB/ET Forward Attach Point Separation Bolt (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 105 Hz @ +3 dB/oct
105 - 400 Hz @ 0.072 g^2/Hz
400 - 775 Hz @ -9 dB/oct
775 - 1500 Hz @ 0.010 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0075 g^2/Hz

Composite = 6.9 g_{rms}

Long. and Tang. Axes

20 - 52 Hz @ 0.012 g^2/Hz
52 - 160 Hz @ +3 dB/oct
160 - 1200 Hz @ 0.038 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.022 g^2/Hz

Composite = 8.0 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.036 g^2/Hz
20 - 85 Hz @ +3 dB/oct
85 - 400 Hz @ 0.15 g^2/Hz
400 - 775 Hz @ -9 dB/oct
775 - 1500 Hz @ 0.022 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.016 g^2/Hz

Composite = 10.1 g_{rms}

Long. and Tang. Axes

20 - 220 Hz @ 0.058 g^2/Hz
220 - 270 Hz @ +6 dB/oct
270 - 1200 Hz @ 0.088 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.053 g^2/Hz

Composite = 12.3 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.056 g^2/Hz
20 - 105 Hz @ +3 dB/oct
105 - 400 Hz @ 0.29 g^2/Hz
400 - 775 Hz @ -9 dB/oct
775 - 1500 Hz @ 0.040 g^2/Hz
1500 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.030 g^2/Hz

Composite = 13.8 g_{rms}

Long. and Tang. Axes

20 - 52 Hz @ 0.048 g^2/Hz
52 - 160 Hz @ +3 dB/oct
160 - 1200 Hz @ 0.15 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.090 g^2/Hz

Composite = 16.1 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

N/A

Input to the SRB/ET Forward Attach Point Separation Bolt (Sheet 2 of 2)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to the Separation Bolt Pressure Cartridges
(NSI Pressure Cartridge)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.014 g^2/Hz
20 - 105 Hz @ +3 dB/oct
105 - 400 Hz @ 0.072 g^2/Hz
400 - 500 Hz @ -9 dB/oct
500 - 1400 Hz @ 0.038 g^2/Hz
1400 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 9.1 g_{rms}

2. Flight Random Vibration Criteria (6 min/axis)

20 Hz @ 0.056 g^2/Hz
20 - 105 Hz @ +3 dB/oct
105 - 400 Hz @ 0.29 g^2/Hz
400 - 500 Hz @ -9 dB/oct
500 - 1400 Hz @ 0.15 g^2/Hz
1400 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 18.2 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

N/A

4. Vehicle Dynamics Criteria

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 1.0 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria (2 shocks/axis)

No shock test required.

* Design Criteria Only

Input to the SRB Holddown Frangible Nut and Bolt

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.00027 g^2/Hz
20 - 90 Hz @ +6 dB/oct
90 - 150 Hz @ 0.0048 g^2/Hz
150 - 165 Hz @ -9 dB/oct
165 - 1000 Hz @ 0.0035 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0018 g^2/Hz

Composite = 2.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.000020 g^2/Hz
20 - 600 Hz @ +5 dB/oct
600 - 1000 Hz @ 0.0062 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0016 g^2/Hz

Composite = 2.6 g_{rms}

2. Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.00094 g^2/Hz
20 - 90 Hz @ +6 dB/oct
90 - 150 Hz @ 0.019 g^2/Hz
150 - 165 Hz @ -9 dB/oct
165 - 1000 Hz @ 0.014 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0070 g^2/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.000080 g^2/Hz
20 - 600 Hz @ +5 dB/oct
600 - 1000 Hz @ 0.025 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0063 g^2/Hz

Composite = 5.3 g_{rms}

3. Vehicle Dynamics Criteria

N/A

4. Shock Test Criteria (2 shocks/axis)

N/A

Input to the SRB Main Parachute at the Upper Ring (Station No. 318)
(Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 60 Hz @ $0.027 \text{ g}^2/\text{Hz}$
60 - 73 Hz @ -6 dB/oct
73 - 400 Hz @ $0.018 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00015 \text{ g}^2/\text{Hz}$

Composite = $3.3 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 600 Hz @ $0.070 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00020 \text{ g}^2/\text{Hz}$

Composite = $2.5 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.017 \text{ g}^2/\text{Hz}$
20 - 28 Hz @ +3 dB/oct
28 - 800 Hz @ $0.023 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00069 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.011 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/oct
40 - 900 Hz @ $0.022 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00090 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 120 Hz @ $0.0083 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 800 Hz @ $0.027 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00069 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0028 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ $0.0056 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 1100 Hz @ $0.020 \text{ g}^2/\text{Hz}$
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0023 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Input to the SRB Main Parachute at the Upper Ring (Station No. 318)
(Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 60 Hz @ $0.11 \text{ g}^2/\text{Hz}$
60 - 73 Hz @ -6 dB/oct
73 - 400 Hz @ $0.075 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00060 \text{ g}^2/\text{Hz}$

Composite = $6.7 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 600 Hz @ $0.029 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00080 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the SRB Main Parachute at the Upper Ring (Station No. 318)
(Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
50 G's peak Amplitude
50 msec Duration

Lateral Axes

Half Sine Pulse
15 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
0.8 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
8.1 G's peak Amplitude
300 msec Duration

Input to the SRB Main Parachute at the Lower Ring (Station No. 367)
(Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 40 Hz @ $0.016 \text{ g}^2/\text{Hz}$
40 - 48 Hz @ -6 dB/oct
48 - 400 Hz @ $0.011 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.000082 \text{ g}^2/\text{Hz}$

Composite = $2.5 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 600 Hz @ $0.0072 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00020 \text{ g}^2/\text{Hz}$

Composite = $2.5 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ $0.017 \text{ g}^2/\text{Hz}$
20 - 28 Hz @ +3 dB/oct
28 - 800 Hz @ $0.023 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00069 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.011 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/oct
40 - 900 Hz @ $0.022 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00090 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 120 Hz @ $0.0083 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 800 Hz @ $0.027 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00069 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 Hz @ $0.0028 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ $0.0051 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 1100 Hz @ $0.020 \text{ g}^2/\text{Hz}$
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0023 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Input to the SRB Main Parachute at the Lower Ring (Station No. 367)
(Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 40 Hz @ $0.063 \text{ g}^2/\text{Hz}$
40 - 48 Hz @ -6 dB/oct
48 - 400 Hz @ $0.043 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00033 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 600 Hz @ $0.029 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00080 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

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Input to the SRB Main Parachute at the Lower Ring (Station No. 367)
(Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Lateral Axes

Half Sine Pulse
50 G's peak Amplitude
50 msec Duration

Half Sine Pulse
15 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Lateral Axes

Half Sine Pulse
0.8 G's peak Amplitude
300 msec Duration

Half Sine Pulse
8.1 G's peak Amplitude
300 msec Duration

Input to the SRB Drogue Parachute at the Lower Ring (Station No. 275)
(Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 50 Hz @ $0.032 \text{ g}^2/\text{Hz}$
50 - 60 Hz @ -6 dB/oct
60 - 400 Hz @ $0.022 \text{ g}^2/\text{Hz}$
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00018 \text{ g}^2/\text{Hz}$

Composite = $3.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 150 Hz @ $0.014 \text{ g}^2/\text{Hz}$
150 - 240 Hz @ -9 dB/oct
240 - 1000 Hz @ $0.0032 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.00042 \text{ g}^2/\text{Hz}$

Composite = $2.5 \text{ g}_{\text{rms}}$

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 - 800 Hz @ $0.024 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00064 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 1100 Hz @ $0.013 \text{ g}^2/\text{Hz}$
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0019 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 120 Hz @ $0.0080 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 800 Hz @ $0.027 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.00068 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 120 Hz @ $0.0056 \text{ g}^2/\text{Hz}$
120 - 180 Hz @ +9 dB/oct
180 - 1100 Hz @ $0.019 \text{ g}^2/\text{Hz}$
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0018 \text{ g}^2/\text{Hz}$

Composite = $5.0 \text{ g}_{\text{rms}}$

Input to the SRB Drogue Parachute at the Lower Ring (Station No. 275)
(Sheet 2 of 2)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 50 Hz @ 0.13 g^2/Hz
50 - 60 Hz @ -6 dB/oct
60 - 400 Hz @ 0.090 g^2/Hz
400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00073 g^2/Hz

Composite = 7.3 g_{rms}

Long. and Tang. Axes

20 - 150 Hz @ 0.055 g^2/Hz
150 - 240 Hz @ -9 dB/oct
240 - 1000 Hz @ 0.013 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0017 g^2/Hz

Composite = 5.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria

No shock test required.

* Design Criteria Only

Input to the Main Chute Release Separation Nut (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 0.32 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.014 g^2/Hz

Composite = 15.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 1000 Hz @ 0.12 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.05 g^2/Hz

Composite = 12.5 g_{rms}

2. Lift-off Random Vibration Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0054 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 320 Hz @ 0.040 g^2/Hz
320 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.065 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0042 g^2/Hz

Composite = 7.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.010 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.050 g^2/Hz
150 - 190 Hz @ -6 dB/oct
190 - 1000 Hz @ 0.030 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0075 g^2/Hz

Composite = 6.8 g_{rms}

3. Boost Random Vibration Criteria (2 min/axis)

Radial Axis

20 Hz @ 0.0071 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.14 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0090 g^2/Hz

Composite = 11.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.060 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.015 g^2/Hz

Composite = 9.3 g_{rms}

Input to the Main Chute Release Separation Nut (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (90 sec/axis)

Radial Axis

20 Hz @ 0.053 g^2/Hz
20 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 1.30 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.056 g^2/Hz

Composite = 31.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.064 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 1000 Hz @ 0.48 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.060 g^2/Hz

Composite = 25.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the Main Chute Release Separation Nut (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 94 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 375 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 15,000 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Integrated Electronics Assembly (IEA)
Located on the Forward Skirt Reaction Ring (Sheet 1 of 4)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 130 Hz @ +3 dB/oct
130 - 580 Hz @ 0.016 g^2/Hz
580 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 4.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 33 Hz @ +3 dB/oct
33 - 930 Hz @ 0.0065 g^2/Hz
930 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 3.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 180 Hz @ 0.018 g^2/Hz
180 - 230 Hz @ +6 dB/oct
230 - 800 Hz @ 0.030 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0020 g^2/Hz

Composite = 5.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 150 Hz @ 0.020 g^2/Hz
150 - 180 Hz @ -6 dB/oct
180 - 1000 Hz @ 0.013 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0033 g^2/Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 130 Hz @ +3 dB/oct
130 - 580 Hz @ 0.065 g^2/Hz
580 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2/Hz

Composite = 7.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 33 Hz @ +3 dB/oct
33 - 930 Hz @ 0.026 g^2/Hz
930 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2/Hz

Composite = 6.1 g_{rms}

Input to the Integrated Electronics Assembly (IEA)
Located on the Forward Skirt Reaction Ring (Sheet 2 of 4)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 200 Hz @ 0.075 g^2/Hz
200 - 245 Hz @ -6 dB/oct
245 - 600 Hz @ 0.050 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 6.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 150 Hz @ 0.090 g^2/Hz
150 - 235 Hz @ -12 dB/oct
235 - 800 Hz @ 0.017 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0028 g^2/Hz

Composite = 5.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the Integrated Electronics Assembly (IEA)
Located on the Forward Skirt Reaction Ring (Sheet 3 of 4)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Lateral Axes

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Lateral Axes

Half Sine Pulse
3.1 G's peak
300 msec Duration

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Integrated Electronics Assembly (IEA)
Located on the Forward Skirt Reaction Ring (Sheet 4 of 4)

7. Acoustic Criteria

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	106.0	105.5		123.0
6.3	108.5	107.5		126.0
8.0	110.5	110.0		129.0
10.0	113.0	112.0	N	131.5
12.5	115.5	114.5		134.0
16.0	117.5	116.5	O	135.5
20.0	119.5	118.5		137.5
25.0	121.5	120.5	T	137.5
31.5	123.5	122.5		138.0
40.0	125.5	124.5		139.0
50.0	127.5	126.5		139.0
63.0	129.0	128.5		139.5
80.0	131.0	131.0	A	140.0
100.0	132.5	133.0		140.5
125.0	133.5	135.0	P	141.0
160.0	134.5	136.0		141.5
200.0	134.5	136.5	P	141.5
250.0	134.0	137.0		141.5
315.0	134.0	137.0	L	141.5
400.0	132.5	135.5		140.5
500.0	131.0	134.0	I	139.0
630.0	129.5	132.5		137.0
800.0	127.5	130.5	C	134.5
1000.0	126.0	129.0		133.0
1250.0	124.0	127.0	A	130.5
1600.0	122.0	125.5		128.0
2000.0	120.5	124.0	B	126.0
2500.0	118.5	122.0		123.5
3150.0	116.0	119.5	L	120.5
4000.0	113.5	117.5		117.5
5000.0	111.5	116.0	E	115.0
6300.0	108.5	113.5		111.5
8000.0	106.0	111.5		109.0
10000.0	104.0	110.0		106.5
Overall SPL	144.0	146.0		152.5
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission		60 sec plus 30 sec per mission

Input to the Integrated Electronics Assembly (IEA) Located Between
The Webs of the SRB/ET Aft Attach Ring (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 50 Hz @ 0.0075 g^2 /Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.022 g^2 /Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0014 g^2 /Hz

Composite = 4.2 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.0050 g^2 /Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.015 g^2 /Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2 /Hz

Composite = 3.4 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

Radial Axis

20 - 50 Hz @ 0.030 g^2 /Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.090 g^2 /Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2 /Hz

Composite = 8.5 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.015 g^2 /Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.045 g^2 /Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0028 g^2 /Hz

Composite = 6.0 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 50 Hz @ 0.030 g^2 /Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.090 g^2 /Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2 /Hz

Composite = 8.5 g_{rms}

Long. and Tang. Axes

20 - 50 Hz @ 0.015 g^2 /Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.045 g^2 /Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0028 g^2 /Hz

Composite = 6.0 g_{rms}

Input to the Integrated Electronics Assembly (IEA) Located Between
The Webs of the SRB/ET Aft Attach Ring (Sheet 2 of 3)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance Shock

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
7 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
1.7 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the Integrated Electronics Assembly (IEA) Located Between
The Webs of the SRB/ET Aft Attach Ring (Sheet 3 of 3)

6. Acoustic Criteria

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	120.0	118.5	147.0	136.0
6.3	121.0	119.5	146.0	137.0
8.0	122.0	120.5	145.0	138.0
10.0	123.5	121.5	144.0	139.5
12.5	125.0	122.5	143.0	140.5
16.0	126.0	123.5	142.0	141.5
20.0	127.5	124.5	141.0	142.5
25.0	129.0	125.5	140.0	144.0
31.5	130.0	126.5	139.0	145.0
40.0	131.5	127.0	138.0	146.0
50.0	132.5	128.0	136.0	147.0
63.0	133.5	129.0	134.0	148.5
80.0	134.0	130.0	132.0	149.5
100.0	134.5	131.0	130.0	150.0
125.0	135.0	132.0	128.0	150.5
160.0	135.5	132.0	126.0	151.0
200.0	135.5	132.5	124.0	151.0
250.0	135.5	133.0	122.0	151.0
315.0	135.0	133.0	120.0	151.0
400.0	135.0	132.5	118.0	150.5
500.0	134.5	132.0	116.0	149.5
630.0	134.0	131.5	114.0	149.0
800.0	133.5	130.5	112.0	147.5
1000.0	133.0	130.0	110.0	146.5
1250.0	132.5	129.0	108.0	145.5
1600.0	132.0	128.5	106.0	144.5
2000.0	131.5	128.0	104.0	143.0
2500.0	131.0	127.0	102.0	142.0
3150.0	130.0	126.0	100.0	141.0
4000.0	129.0	125.5	98.0	140.0
5000.0	128.0	125.0	96.0	139.0
6300.0	127.0	124.0	94.0	138.0
8000.0	126.0	123.5	92.0	137.0
10000.0	125.0	123.0	90.0	136.0
Overall SPL	147.5	144.0	153.5	152.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Input to the Integrated Electronics Assembly (IEA) Multiple Locations
(Aft Attach Ring and Forward Skirt Reaction Ring) (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.015 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 500 Hz @ 0.022 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 4.4 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 - 50 Hz @ 0.030 g^2/Hz
50 - 150 Hz @ +3 dB/oct
150 - 500 Hz @ 0.090 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2/Hz

Composite = 8.5 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

20 Hz @ 0.060 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 500 Hz @ 0.090 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0056 g^2/Hz

Composite = 8.8 g_{rms}

Input to the Integrated Electronics Assembly (IEA) Multiple Locations
(Aft Attach Ring and Forward Skirt Reaction Ring) (Sheet 2 of 3)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the Integrated Electronics Assembly (IEA) Multiple Locations
(Aft Attach Ring and Forward Reaction Ring) (Sheet 3 of 3)

6. Acoustic Criteria

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	120.0	118.5	147.0	136.0
6.3	121.0	119.5	146.0	137.0
8.0	122.0	120.5	145.0	138.0
10.0	123.5	121.5	144.0	139.5
12.5	125.0	122.5	143.0	140.5
16.0	126.0	123.5	142.0	141.5
20.0	127.5	124.5	141.0	142.5
25.0	129.0	125.5	140.0	144.0
31.5	130.0	126.5	139.0	145.0
40.0	131.5	127.0	138.0	146.0
50.0	132.5	128.0	136.0	147.0
63.0	133.5	129.0	134.0	148.0
80.0	134.0	131.0	132.0	149.5
100.0	134.5	133.0	130.0	150.0
125.0	135.0	135.0	128.0	150.5
160.0	135.5	136.0	126.0	151.0
200.0	135.5	136.5	124.0	151.0
250.0	135.5	137.0	122.0	151.0
315.0	135.0	137.0	120.0	151.0
400.0	135.0	135.5	118.0	150.5
500.0	134.5	134.0	116.0	149.5
630.0	134.0	132.5	114.0	149.0
800.0	133.5	130.5	112.0	147.5
1000.0	133.0	130.0	110.0	146.5
1250.0	132.5	129.0	108.0	145.5
1600.0	132.0	128.5	106.0	144.5
2000.0	131.5	128.0	104.0	143.0
2500.0	131.0	127.0	102.0	142.0
3150.0	130.0	126.0	100.0	141.0
4000.0	129.0	125.5	98.0	140.0
5000.0	128.0	125.0	96.0	139.0
6300.0	127.0	124.0	94.0	138.0
8000.0	126.0	123.5	92.0	137.0
10000.0	125.0	123.0	90.0	136.0
Overall SPL	147.5	146.5	153.5	162.0
Duration	30 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Input to the IEA Multiplexer Interface Adapter (MIA) (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ $0.032 \text{ g}^2/\text{Hz}$
20 - 300 Hz @ +4 dB/oct
300 - 800 Hz @ $1.00 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.025 \text{ g}^2/\text{Hz}$

Composite = $29.7 \text{ g}_{\text{rms}}$

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 Hz @ $0.13 \text{ g}^2/\text{Hz}$
20 - 300 Hz @ +4 dB/oct
300 - 800 Hz @ $4.00 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.10 \text{ g}^2/\text{Hz}$

Composite = $59.5 \text{ g}_{\text{rms}}$

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

20 Hz @ $0.13 \text{ g}^2/\text{Hz}$
20 - 300 Hz @ +4 dB/oct
300 - 800 Hz @ $4.00 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.10 \text{ g}^2/\text{Hz}$

Composite = $59.5 \text{ g}_{\text{rms}}$

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the IEA Multiplexer Interface Adapter (MIA) (Sheet 2 of 3)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the IEA Multiplexer Interface Adapter (MIA) (Sheet 3 of 3)

6. Acoustic Criteria

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	99.0	97.5	126.0	115.0
6.3	100.0	98.5	125.0	116.0
8.0	101.0	99.5	124.0	117.0
10.0	102.5	100.5	123.0	118.5
12.5	104.0	101.5	122.0	119.5
16.0	105.0	102.5	121.0	120.5
20.0	106.5	103.5	120.0	121.5
25.0	108.0	104.5	119.0	123.0
31.5	109.0	105.5	118.0	124.0
40.0	110.5	106.0	117.0	125.0
50.0	111.5	107.0	115.0	126.0
63.0	112.5	108.0	113.0	127.5
80.0	113.0	110.0	111.0	128.5
100.0	113.5	111.0	109.0	129.0
125.0	114.0	114.0	107.0	129.5
160.0	114.5	115.0	105.0	130.0
200.0	114.5	115.5	103.0	130.0
250.0	114.5	116.0	101.0	130.0
315.0	114.0	116.0	99.0	130.0
400.0	114.0	114.5	97.0	129.5
500.0	113.5	113.0	95.0	128.5
630.0	113.0	111.5	93.0	128.0
800.0	112.5	109.5	90.0	126.5
1000.0	112.0	109.0	89.0	125.5
1250.0	111.0	108.0	87.0	124.5
1600.0	111.0	107.5	85.0	123.5
2000.0	110.5	107.0	83.0	122.0
2500.0	110.0	106.0	81.0	121.0
3150.0	109.0	105.0	80.0	120.0
4000.0	108.0	104.5	77.0	119.0
5000.0	107.0	104.0	75.0	118.0
6300.0	106.0	103.0	73.0	117.0
8000.0	105.0	102.5	71.0	116.0
10000.0	104.0	102.0	69.0	115.0
Overall SPL	126.5	125.5	132.5	141.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Input to the IEA Internal Components (Components Mounted to the Inside
IEA Housing Except the Multiplexer De-Multiplexer) (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.032 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 500 Hz @ 0.12 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0078 g^2/Hz

Composite = 10.2 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 Hz @ 0.13 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 500 Hz @ 0.50 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.031 g^2/Hz

Composite = 20.4 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

20 Hz @ 0.13 g^2/Hz
20 - 80 Hz @ +3 dB/oct
80 - 500 Hz @ 0.50 g^2/Hz
500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.031 g^2/Hz

Composite = 20.4 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the IEA Internal Components (Components Mounted to the Inside
IEA Housing Except the Multiplexer De-Multiplexer) (Sheet 2 of 3)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

**Input to the IEA Internal Components (Components Mounted to the Inside
IEA Housing Except the Multiplexer De-Multiplexer) (Sheet 3 of 3)**

6. Acoustic Criteria

(One third Octave Band Acoustic Specification in dB re $20 \mu\text{N/m}^2$)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	111.0	109.5	138.0	127.0
6.3	112.0	110.5	137.0	128.0
8.0	113.0	111.5	136.0	129.0
10.0	114.5	112.5	135.0	130.5
12.5	116.0	113.5	134.0	131.5
16.0	117.0	114.5	133.0	132.5
20.0	118.5	115.5	132.0	133.5
25.0	120.0	116.5	131.0	135.0
31.5	121.0	117.5	130.0	136.0
40.0	122.5	118.0	129.0	137.0
50.0	123.5	119.0	127.0	138.0
63.0	124.5	120.0	125.0	139.5
80.0	125.0	122.0	123.0	140.5
100.0	125.5	123.0	121.0	141.0
125.0	126.0	126.0	119.0	141.5
160.0	126.5	127.0	117.0	142.0
200.0	126.5	127.5	115.0	142.0
250.0	126.5	128.0	113.0	142.0
315.0	126.0	128.0	111.0	142.0
400.0	126.0	126.5	109.0	141.5
500.0	125.5	125.0	107.0	140.5
630.0	125.0	123.5	105.0	140.0
800.0	124.5	121.5	102.0	138.5
1000.0	124.0	121.0	101.0	137.5
1250.0	123.0	120.0	99.0	136.5
1600.0	123.0	119.5	97.0	135.5
2000.0	122.5	119.0	95.0	134.0
2500.0	122.0	118.0	93.0	133.0
3150.0	121.0	117.0	92.0	132.0
4000.0	120.0	116.5	89.0	131.0
5000.0	119.0	116.0	87.0	130.0
6300.0	118.0	115.0	85.0	129.0
8000.0	117.0	114.5	83.0	128.0
10000.0	116.0	114.0	81.0	127.0
Overall SPL	138.5	137.5	144.5	153.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Input to the IEA Multiplexer De-Multiplexer (MDM) Assembly
(Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Tangential Axis

20 Hz @ $0.018 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +2 dB/oct
120 - 300 Hz @ $0.062 \text{ g}^2/\text{Hz}$
300 - 2000 Hz @ -7 dB/oct
2000 Hz @ $0.00070 \text{ g}^2/\text{Hz}$

Composite = $5.3 \text{ g}_{\text{rms}}$

Radial and Longitudinal Axes

20 - 230 Hz @ $0.025 \text{ g}^2/\text{Hz}$
230 - 300 Hz @ +10 dB/oct
300 - 600 Hz @ $0.062 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.0055 \text{ g}^2/\text{Hz}$

Composite = $7.3 \text{ g}_{\text{rms}}$

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

Tangential Axis

20 Hz @ $0.070 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +2 dB/oct
120 - 300 Hz @ $0.25 \text{ g}^2/\text{Hz}$
300 - 2000 Hz @ -7 dB/oct
2000 Hz @ $0.0028 \text{ g}^2/\text{Hz}$

Composite = $10.7 \text{ g}_{\text{rms}}$

Radial and Longitudinal Axes

20 - 230 Hz @ $0.10 \text{ g}^2/\text{Hz}$
230 - 300 Hz @ +10 dB/oct
300 - 600 Hz @ $0.25 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.022 \text{ g}^2/\text{Hz}$

Composite = $14.6 \text{ g}_{\text{rms}}$

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Tangential Axis

20 Hz @ $0.070 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +2 dB/oct
120 - 300 Hz @ $0.25 \text{ g}^2/\text{Hz}$
300 - 2000 Hz @ -7 dB/oct
2000 Hz @ $0.0028 \text{ g}^2/\text{Hz}$

Composite = $10.7 \text{ g}_{\text{rms}}$

Radial and Longitudinal Axes

20 - 230 Hz @ $0.10 \text{ g}^2/\text{Hz}$
230 - 300 Hz @ +10 dB/oct
300 - 600 Hz @ $0.25 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.022 \text{ g}^2/\text{Hz}$

Composite = $14.6 \text{ g}_{\text{rms}}$

Input to the IEA Multiplexer De-Multiplexer (MDM) Assembly
(Sheet 2 of 3)

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the IEA Multiplexer De-Multiplexer (MDM) Assembly
(Sheet 3 of 3)

6. Acoustic Criteria

(One-third Octave Band Acoustic Specification in dB re 20 μ N/m²)

<u>Geometric Mean Frequency (Hz)</u>	<u>Lift-off</u>	<u>In-flight Fluctuating Pressure</u>	<u>Oscillating Shock</u>	<u>Reentry</u>
5.0	111.0	109.5	138.0	127.0
6.3	112.0	110.5	137.0	128.0
8.0	113.0	111.5	136.0	129.0
10.0	114.5	112.5	135.0	130.5
12.5	116.0	113.5	134.0	131.5
16.0	117.0	114.5	133.0	132.5
20.0	118.5	115.5	132.0	133.5
25.0	120.0	116.5	131.0	135.0
31.5	121.0	117.5	130.0	136.0
40.0	122.5	118.0	129.0	137.0
50.0	123.5	119.0	127.0	138.0
63.0	124.5	120.0	125.0	139.5
80.0	125.0	122.0	123.0	140.5
100.0	125.5	123.0	121.0	141.0
125.0	126.0	126.0	119.0	141.5
160.0	126.5	127.0	117.0	142.0
200.0	126.5	127.5	115.0	142.0
250.0	126.5	128.0	113.0	142.0
315.0	126.0	128.0	111.0	142.0
400.0	126.0	126.5	109.0	141.5
500.0	125.5	125.0	107.0	140.5
630.0	125.0	123.5	105.0	140.0
800.0	124.5	121.5	103.0	138.5
1000.0	124.0	121.0	101.0	137.5
1250.0	123.0	120.0	99.0	136.5
1600.0	123.0	119.5	97.0	135.5
2000.0	122.5	119.0	95.0	134.0
2500.0	122.0	118.0	93.0	133.0
3150.0	121.0	117.0	91.0	132.0
4000.0	120.0	116.5	89.0	131.0
5000.0	119.0	116.0	87.0	130.0
6300.0	118.0	115.0	85.0	129.0
8000.0	117.0	114.5	83.0	128.0
10000.0	116.0	114.0	81.0	127.0
Overall SPL	138.5	137.5	144.5	153.0
Duration	50 sec plus 10 sec per mission	80 sec plus 40 sec per mission	N/A	60 sec plus 30 sec per mission

Input to the TVC System Upper Frame Assembly (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 55 Hz @ +6 dB/oct
55 - 200 Hz @ 0.095 g^2/Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.012 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0024 g^2/Hz

Composite = 5.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0035 g^2/Hz
20 - 75 Hz @ +6 dB/oct
75 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0080 g^2/Hz

Composite = 7.8 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 200 Hz @ 0.063 g^2/Hz
200 - 285 Hz @ -12 dB/oct
285 - 1200 Hz @ 0.015 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0090 g^2/Hz

Composite = 6.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 65 Hz @ +3 dB/oct
65 - 1000 Hz @ 0.050 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 9.1 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 200 Hz @ 0.10 g^2/Hz
200 - 360 Hz @ -12 dB/oct
360 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 6.1 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.045 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 8.3 g_{rms}

Input to the TVC System Upper Frame Assembly (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ $0.052 g^2/Hz$
20 - 55 Hz @ +6 dB/oct
55 - 200 Hz @ $0.38 g^2/Hz$
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ $0.050 g^2/Hz$
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.0097 g^2/Hz$

Composite = $11.4 g_{rms}$

Long. and Tang. Axes

20 Hz @ $0.014 g^2/Hz$
20 - 75 Hz @ +6 dB/oct
75 - 800 Hz @ $0.20 g^2/Hz$
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.032 g^2/Hz$

Composite = $15.7 g_{rms}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

* Design Criteria Only

Input to the TVC System Upper Frame Assembly (Sheet 3 of 3)

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes_____

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to Auxiliary Propulsion Unit and Pump (Sheet 1 of 5)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 105 Hz @ 0.21 g^2/Hz
105 - 200 Hz @ +9 dB/oct
200 - 270 Hz @ 1.50 g^2/Hz
270 - 420 Hz @ -12 dB/oct
420 - 800 Hz @ 0.25 g^2/Hz
800 - 1000 Hz @ -15 dB/oct
1000 - 1400 Hz @ 0.075 g^2/Hz
1400 - 1630 Hz @ +15 dB/oct
1630 - 2000 Hz @ 0.16 g^2/Hz

Composite = 22.9 g_{rms}

Longitudinal Axis

20 Hz @ 0.0030 g^2/Hz
20 - 120 Hz @ +9 dB/oct
120 - 180 Hz @ 0.62 g^2/Hz
180 - 250 Hz @ -12 dB/oct
250 - 1100 Hz @ 0.18 g^2/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.052 g^2/Hz

Composite = 17.7 g_{rms}

Tangential Axis

20 Hz @ 0.0095 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 230 Hz @ 0.25 g^2/Hz
230 - 270 Hz @ -12 dB/oct
270 - 900 Hz @ 0.12 g^2/Hz
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0052 g^2/Hz

Composite = 12.7 g_{rms}

Input to Auxiliary Propulsion Unit and Pump (Sheet 2 of 5)

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.024 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 0.15 g^2/Hz
100 - 180 Hz @ +12 dB/oct
180 - 300 Hz @ 1.50 g^2/Hz
300 - 450 Hz @ -15 dB/oct
450 - 1200 Hz @ 0.20 g^2/Hz
1200 - 1580 Hz @ +15 dB/oct
1580 - 2000 Hz @ 0.80 g^2/Hz

Composite = 31.4 g_{rms}

Longitudinal Axis

20 Hz @ 0.017 g^2/Hz
20 - 110 Hz @ +6 dB/oct
110 - 180 Hz @ 0.50 g^2/Hz
180 - 250 Hz @ -12 dB/oct
250 - 850 Hz @ 0.13 g^2/Hz
850 - 1000 Hz @ +12 dB/oct
1000 - 2000 Hz @ 0.25 g^2/Hz

Composite = 20.7 g_{rms}

Tangential Axis

20 Hz @ 0.028 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 85 Hz @ 0.070 g^2/Hz
85 - 120 Hz @ +15 dB/oct
120 - 300 Hz @ 0.38 g^2/Hz
300 - 1200 Hz @ -4 dB/oct
1200 - 2000 Hz @ 0.060 g^2/Hz

Composite = 15.9 g_{rms}

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Input to Auxiliary Propulsion Unit and Pump (Sheet 3 of 5)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 100 Hz @ 0.25 g^2/Hz
100 - 180 Hz @ +12 dB/oct
180 - 300 Hz @ 2.50 g^2/Hz
300 - 540 Hz @ -15 dB/oct
540 - 1200 Hz @ 0.13 g^2/Hz
1200 - 1575 Hz @ +15 dB/oct
1575 - 2000 Hz @ 0.50 g^2/Hz

Composite = 31.3 g_{rms}

Longitudinal Axis

20 Hz @ 0.040 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 80 Hz @ 0.080 g^2/Hz
80 - 120 Hz @ +12 dB/oct
120 - 180 Hz @ 0.44 g^2/Hz
180 - 240 Hz @ -12 dB/oct
240 - 850 Hz @ 0.13 g^2/Hz
850 - 1000 Hz @ +12 dB/oct
1000 - 2000 Hz @ 0.24 g^2/Hz

Composite = 20.0 g_{rms}

Tangential Axis

20 Hz @ 0.053 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 90 Hz @ 0.080 g^2/Hz
90 - 120 Hz @ +15 dB/oct
120 - 300 Hz @ 0.34 g^2/Hz
300 - 1375 Hz @ -4 dB/oct
1375 - 2000 Hz @ 0.045 g^2/Hz

Composite = 14.9 g_{rms}

Input to Auxiliary Propulsion Unit and Pump (Sheet 4 of 5)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.055 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 105 Hz @ 0.85 g^2/Hz
105 - 200 Hz @ +9 dB/oct
200 - 270 Hz @ 6.00 g^2/Hz
270 - 420 Hz @ -12 dB/oct
420 - 800 Hz @ 1.00 g^2/Hz
800 - 1000 Hz @ -15 dB/oct
1000 - 1400 Hz @ 0.30 g^2/Hz
1400 - 1630 Hz @ +15 dB/oct
1630 - 2000 Hz @ 0.65 g^2/Hz

Composite = 45.9 g_{rms}

Longitudinal Axis

20 Hz @ 0.012 g^2/Hz
20 - 120 Hz @ +9 dB/oct
120 - 180 Hz @ 2.50 g^2/Hz
180 - 250 Hz @ -12 dB/oct
250 - 1100 Hz @ 0.70 g^2/Hz
1100 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.21 g^2/Hz

Composite = 35.5 g_{rms}

Tangential Axis

20 Hz @ 0.038 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 230 Hz @ 1.00 g^2/Hz
230 - 270 Hz @ -12 dB/oct
270 - 900 Hz @ 0.50 g^2/Hz
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.021 g^2/Hz

Composite = 25.4 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

*Design Criteria Only

Input to Auxiliary Propulsion Unit and Pump (Sheet 5 of 5)

6. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to High Pressure Filter and Fuel Isolation Valve (Sheet 1 of 5)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
20 - 40 Hz @ +9 dB/oct
40 - 110 Hz @ 0.15 g^2/Hz
110 - 200 Hz @ +12 dB/oct
200 - 270 Hz @ 1.75 g^2/Hz
270 - 400 Hz @ -12 dB/oct
400 - 900 Hz @ 0.38 g^2/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.032 g^2/Hz

Composite = 25.0 g_{rms}

Longitudinal Axis

20 Hz @ 0.014 g^2/Hz
20 - 120 Hz @ +6 dB/oct
120 - 800 Hz @ 0.50 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0325 g^2/Hz

Composite = 22.9 g_{rms}

Tangential Axis

20 Hz @ 0.010 g^2/Hz
20 - 100 Hz @ +6 dB/oct
100 - 250 Hz @ 0.25 g^2/Hz
250 - 360 Hz @ +9 dB/oct
360 - 800 Hz @ 0.75 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.048 g^2/Hz

Composite = 26.1 g_{rms}

Input to High Pressure Filter and Fuel Isolation Valve (Sheet 2 of 5)

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.021 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 110 Hz @ 0.13 g^2/Hz
110 - 190 Hz @ +15 dB/oct
190 - 240 Hz @ 2.00 g^2/Hz
240 - 315 Hz @ -12 dB/oct
315 - 1500 Hz @ 0.70 g^2/Hz
1500 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.29 g^2/Hz

Composite = 36.3 g_{rms}

Longitudinal Axis

20 - 58 Hz @ 0.030 g^2/Hz
58 - 110 Hz @ +12 dB/oct
110 - 160 Hz @ 0.40 g^2/Hz
160 - 200 Hz @ -6 dB/oct
200 - 1600 Hz @ 0.25 g^2/Hz
1600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.13 g^2/Hz

Composite = 21.5 g_{rms}

Tangential Axis

20 Hz @ 0.026 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 82 Hz @ 0.065 g^2/Hz
82 - 120 Hz @ +12 dB/oct
120 - 600 Hz @ 0.30 g^2/Hz
600 - 1475 Hz @ -6 dB/oct
1475 - 2000 Hz @ 0.050 g^2/Hz

Composite = 16.9 g_{rms}

Input to High Pressure Filter and Fuel Isolation Valve (Sheet 3 of 5)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.080 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 110 Hz @ 0.20 g^2/Hz
110 - 190 Hz @ +15 dB/oct
190 - 240 Hz @ 3.00 g^2/Hz
240 - 340 Hz @ -15 dB/oct
340 - 1200 Hz @ 0.50 g^2/Hz
1200 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.11 g^2/Hz

Composite = 31.9 g_{rms}

Longitudinal Axis

20 - 67 Hz @ 0.060 g^2/Hz
67 - 110 Hz @ +12 dB/oct
110 - 160 Hz @ 0.40 g^2/Hz
160 - 225 Hz @ -6 dB/oct
225 - 1600 Hz @ 0.20 g^2/Hz
1600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.10 g^2/Hz

Composite = 19.6 g_{rms}

Tangential Axis

20 - 84 Hz @ 0.070 g^2/Hz
84 - 120 Hz @ +12 dB/oct
120 - 600 Hz @ 0.30 g^2/Hz
600 - 1200 Hz @ -6 dB/oct
1200 - 2000 Hz @ 0.075 g^2/Hz

Composite = 17.4 g_{rms}

Input to High Pressure Filter and Fuel Isolation Valve (Sheet 4 of 5)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ $0.075 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +9 dB/oct
40 - 110 Hz @ $0.60 \text{ g}^2/\text{Hz}$
110 - 200 Hz @ +12 dB/oct
200 - 270 Hz @ $7.00 \text{ g}^2/\text{Hz}$
270 - 400 Hz @ -12 dB/oct
400 - 900 Hz @ $1.50 \text{ g}^2/\text{Hz}$
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.13 \text{ g}^2/\text{Hz}$

Composite = $50.1 \text{ g}_{\text{rms}}$

Longitudinal Axis

20 Hz @ $0.056 \text{ g}^2/\text{Hz}$
20 - 120 Hz @ +6 dB/oct
120 - 800 Hz @ $2.00 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.13 \text{ g}^2/\text{Hz}$

Composite = $45.9 \text{ g}_{\text{rms}}$

Tangential Axis

20 Hz @ $0.042 \text{ g}^2/\text{Hz}$
20 - 100 Hz @ +6 dB/oct
100 - 250 Hz @ $1.00 \text{ g}^2/\text{Hz}$
250 - 360 Hz @ +9 dB/oct
360 - 800 Hz @ $3.00 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.19 \text{ g}^2/\text{Hz}$

Composite = $52.2 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

* Design Criteria Only

Input to High Pressure Filter and Fuel Isolation Valve (Sheet 5 of 5)

6. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction of equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

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Input to the TVC System Lower Frame Assembly (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 45 Hz @ +6 dB/oct
45 - 200 Hz @ 0.065 g^2/Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.0085 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0014 g^2/Hz

Composite = 4.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0035 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 800 Hz @ 0.032 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0052 g^2/Hz

Composite = 6.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 41 Hz @ +6 dB/oct
41 - 200 Hz @ 0.042 g^2/Hz
200 - 285 Hz @ -12 dB/oct
285 - 1200 Hz @ 0.010 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0060 g^2/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 43 Hz @ +3 dB/oct
43 - 1000 Hz @ 0.034 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.017 g^2/Hz

Composite = 7.5 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 200 Hz @ 0.068 g^2/Hz
200 - 360 Hz @ -12 dB/oct
360 - 1000 Hz @ 0.0068 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0034 g^2/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.031 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 6.9 g_{rms}

Input to the TVC System Lower Frame Assembly (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2 /Hz
20 - 45 Hz @ +6 dB/oct
45 - 200 Hz @ 0.26 g^2 /Hz
200 - 395 Hz @ -9 dB/oct
395 - 800 Hz @ 0.34 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0055 g^2 /Hz

Composite = 9.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.014 g^2 /Hz
20 - 60 Hz @ +6 dB/oct
60 - 800 Hz @ 0.13 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.021 g^2 /Hz

Composite = 12.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

* Design Criteria Only

Input to the TVC System Lower Frame Assembly (Sheet 3 of 3)

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to Manifold (Sheet 1 of 5)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 140 Hz @ 0.22 g^2/Hz
140 - 250 Hz @ +9 dB/oct
250 - 600 Hz @ 1.25 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.035 g^2/Hz

Composite = 29.6 g_{rms}

Longitudinal Axis

20 Hz @ 0.0035 g^2/Hz
20 - 120 Hz @ +9 dB/oct
120 - 900 Hz @ 0.75 g^2/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.070 g^2/Hz

Composite = 29.6 g_{rms}

Tangential Axis

20 Hz @ 0.0075 g^2/Hz
20 - 60 Hz @ +9 dB/oct
60 - 900 Hz @ 0.20 g^2/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.018 g^2/Hz

Composite = 15.6 g_{rms}

Input to Manifold (Sheet 2 of 5)

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.016 g^2/Hz
20 - 60 Hz @ +6 dB/oct
60 - 120 Hz @ 0.15 g^2/Hz
120 - 250 Hz @ +12 dB/oct
250 - 500 Hz @ 3.00 g^2/Hz
500 - 830 Hz @ -12 dB/oct
830 - 2000 Hz @ 0.40 g^2/Hz

Composite = 41.9 g_{rms}

Longitudinal Axis

20 Hz @ 0.020 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 65 Hz @ 0.040 g^2/Hz
65 - 120 Hz @ +12 dB/oct
120 - 1000 Hz @ 0.50 g^2/Hz
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.032 g^2/Hz

Composite = 24.5 g_{rms}

Tangential Axis

20 Hz @ 0.025 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 75 Hz @ 0.050 g^2/Hz
75 - 140 Hz @ +12 dB/oct
140 - 1000 Hz @ 0.60 g^2/Hz
1000 - 1525 Hz @ -9 dB/oct
1525 - 2000 Hz @ 0.17 g^2/Hz

Composite = 28.0 g_{rms}

Input to Manifold (Sheet 3 of 5)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ $0.088 \text{ g}^2/\text{Hz}$
20 - 50 Hz @ +3 dB/oct
50 - 110 Hz @ $0.22 \text{ g}^2/\text{Hz}$
110 - 200 Hz @ +12 dB/oct
200 - 400 Hz @ $2.50 \text{ g}^2/\text{Hz}$
400 - 930 Hz @ -9 dB/oct
930 - 2000 Hz @ $0.20 \text{ g}^2/\text{Hz}$

Composite = $35.1 \text{ g}_{\text{rms}}$

Longitudinal Axis

20 - 68 Hz @ $0.050 \text{ g}^2/\text{Hz}$
68 - 120 Hz @ +12 dB/oct
120 - 1000 Hz @ $0.50 \text{ g}^2/\text{Hz}$
1000 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.032 \text{ g}^2/\text{Hz}$

Composite = $24.5 \text{ g}_{\text{rms}}$

Tangential Axis

20 - 80 Hz @ $0.060 \text{ g}^2/\text{Hz}$
80 - 140 Hz @ +12 dB/oct
140 - 1000 Hz @ $0.55 \text{ g}^2/\text{Hz}$
1000 - 1550 Hz @ -9 dB/oct
1550 - 2000 Hz @ $0.15 \text{ g}^2/\text{Hz}$

Composite = $26.8 \text{ g}_{\text{rms}}$

Input to Manifold (Sheet 4 of 5)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.058 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 140 Hz @ 0.90 g^2/Hz
140 - 250 Hz @ +9 dB/oct
250 - 600 Hz @ 5.00 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.14 g^2/Hz

Composite = 59.2 g_{rms}

Longitudinal Axis

20 Hz @ 0.014 g^2/Hz
20 - 120 Hz @ +9 dB/oct
120 - 900 Hz @ 3.00 g^2/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.28 g^2/Hz

Composite = 59.2 g_{rms}

Tangential Axis

20 Hz @ 0.030 g^2/Hz
20 - 60 Hz @ +9 dB/oct
60 - 900 Hz @ 0.80 g^2/Hz
900 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.074 g^2/Hz

Composite = 31.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

* Design Criteria Only

Input to Manifold (Sheet 5 of 5)

6. Shock Test Criteria (2 shocks/axis)

Test will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

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Input to Reservoir (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 100 Hz @ +9 dB/oct
100 - 200 Hz @ 1.25 g^2/Hz
200 - 650 Hz @ -9 dB/oct
650 - 2000 Hz @ 0.038 g^2/Hz

Composite = 17.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0018 g^2/Hz
20 - 150 Hz @ +9 dB/oct
150 - 300 Hz @ 0.75 g^2/Hz
300 - 590 Hz @ -9 dB/oct
590 - 2000 Hz @ 0.10 g^2/Hz

Composite = 19.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 - 52 Hz @ 0.050 g^2/Hz
52 - 110 Hz @ +18 dB/oct
110 - 180 Hz @ 5.00 g^2/Hz
180 - 580 Hz @ -9 dB/oct
580 - 2000 Hz @ 0.15 g^2/Hz

Composite = 32.3 g_{rms}

Long. and Tang. Axes

20 - 60 Hz @ 0.050 g^2/Hz
60 - 140 Hz @ +12 dB/oct
140 - 300 Hz @ 1.50 g^2/Hz
300 - 590 Hz @ -9 dB/oct
590 - 2000 Hz @ 0.20 g^2/Hz

Composite = 27.1 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 55 Hz @ 0.075 g^2/Hz
55 - 110 Hz @ +18 dB/oct
110 - 200 Hz @ 5.00 g^2/Hz
200 - 540 Hz @ -12 dB/oct
540 - 2000 Hz @ 0.10 g^2/Hz

Composite = 31.5 g_{rms}

Long. and Tang. Axes

20 - 65 Hz @ 0.060 g^2/Hz
65 - 145 Hz @ +12 dB/oct
145 - 300 Hz @ 1.50 g^2/Hz
300 - 680 Hz @ -9 dB/oct
680 - 2000 Hz @ 0.13 g^2/Hz

Composite = 25.1 g_{rms}

Input to Reservoir (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.041 g^2 /Hz
20 - 100 Hz @ +9 dB/oct
100 - 200 Hz @ 5.00 g^2 /Hz
200 - 650 Hz @ -9 dB/oct
650 - 2000 Hz @ 0.15 g^2 /Hz

Composite = 35.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0072 g^2 /Hz
20 - 150 Hz @ +9 dB/oct
150 - 300 Hz @ 3.00 g^2 /Hz
300 - 590 Hz @ -9 dB/oct
590 - 2000 Hz @ 0.40 g^2 /Hz

Composite = 38.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

* Design Criteria Only

Input to Reservoir (Sheet 3 of 3)

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to Fuel Supply Module (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 100 Hz @ +9 dB/oct
100 - 250 Hz @ 1.25 g^2/Hz
250 - 450 Hz @ -12 dB/oct
450 - 1000 Hz @ 0.12 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.016 g^2/Hz

Composite = 20.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0018 g^2/Hz
20 - 180 Hz @ +9 dB/oct
180 - 300 Hz @ 1.25 g^2/Hz
300 - 565 Hz @ -12 dB/oct
565 - 2000 Hz @ 0.10 g^2/Hz

Composite = 21.3 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0080 g^2/Hz
20 - 100 Hz @ +12 dB/oct
100 - 150 Hz @ 5.00 g^2/Hz
150 - 600 Hz @ -9 dB/oct
600 - 2000 Hz @ 0.080 g^2/Hz

Composite = 28.6 g_{rms}

Long. and Tang. Axes

20 - 70 Hz @ 0.050 g^2/Hz
70 - 120 Hz @ +18 dB/oct
120 - 300 Hz @ 1.40 g^2/Hz
300 - 630 Hz @ -9 dB/oct
630 - 2000 Hz @ 0.15 g^2/Hz

Composite = 25.4 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 36 Hz @ 0.080 g^2/Hz
36 - 100 Hz @ +12 dB/oct
100 - 150 Hz @ 5.00 g^2/Hz
150 - 675 Hz @ -9 dB/oct
675 - 2000 Hz @ 0.055 g^2/Hz

Composite = 27.8 g_{rms}

Long. and Tang. Axes

20 - 75 Hz @ 0.060 g^2/Hz
75 - 120 Hz @ +18 dB/oct
120 - 300 Hz @ 1.20 g^2/Hz
300 - 700 Hz @ -9 dB/oct
700 - 2000 Hz @ 0.10 g^2/Hz

Composite = 22.6 g_{rms}

Input to Fuel Supply Module (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.040 g^2 /Hz
20 - 100 Hz @ +9 dB/oct
100 - 250 Hz @ 5.00 g^2 /Hz
250 - 450 Hz @ -12 dB/oct
450 - 1000 Hz @ 0.50 g^2 /Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.065 g^2 /Hz

Composite = 41.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0070 g^2 /Hz
20 - 180 Hz @ +9 dB/oct
180 - 300 Hz @ 5.00 g^2 /Hz
300 - 565 Hz @ -12 dB/oct
565 - 2000 Hz @ 0.40 g^2 /Hz

Composite = 42.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

6. Shock Test Criteria (2 shocks/axis).

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

* Design Criteria Only

Input to Fuel Supply Module (Sheet 3 of 3)

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

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Input to Fuel Supply Module OFI Pressure Sensor (Sheet 1 of 5)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0019 g^2/Hz
20 - 100 Hz @ +12 dB/oct
100 - 150 Hz @ 1.25 g^2/Hz
150 - 715 Hz @ -12 dB/oct
715 - 1150 Hz @ 0.0025 g^2/Hz
1150 - 1500 Hz @ +15 dB/oct
1500 - 2000 Hz @ 0.010 g^2/Hz

Composite = 12.5 g_{rms}

Longitudinal Axis

20 Hz @ 0.000052 g^2/Hz
20 - 150 Hz @ +15 dB/oct
150 - 250 Hz @ 1.25 g^2/Hz
250 - 1100 Hz @ -9 dB/oct
1100 - 2000 Hz @ 0.015 g^2/Hz

Composite = 17.8 g_{rms}

Tangential Axis

20 Hz @ 0.00016 g^2/Hz
20 - 120 Hz @ +15 dB/oct
120 - 250 Hz @ 1.25 g^2/Hz
250 - 1180 Hz @ -12 dB/oct
1180 - 2000 Hz @ 0.0025 g^2/Hz

Composite = 17.1 g_{rms}

Input to Fuel Supply Module OFI Pressure Sensor (Sheet 2 of 5)

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 - 45 Hz @ $0.040 \text{ g}^2/\text{Hz}$
45 - 100 Hz @ +18 dB/oct
100 - 150 Hz @ $5.00 \text{ g}^2/\text{Hz}$
150 - 720 Hz @ -12 dB/oct
720 - 1200 Hz @ $0.010 \text{ g}^2/\text{Hz}$
1200 - 1500 Hz @ +15 dB/oct
1500 - 2000 Hz @ $0.030 \text{ g}^2/\text{Hz}$

Composite = $24.3 \text{ g}_{\text{rms}}$

Longitudinal Axis

20 - 65 Hz @ $0.040 \text{ g}^2/\text{Hz}$
65 - 150 Hz @ +9 dB/oct
150 - 400 Hz @ $0.50 \text{ g}^2/\text{Hz}$
400 - 775 Hz @ -9 dB/oct
775 - 2000 Hz @ $0.070 \text{ g}^2/\text{Hz}$

Composite = $17.4 \text{ g}_{\text{rms}}$

Tangential Axis

20 - 58 Hz @ $0.040 \text{ g}^2/\text{Hz}$
58 - 130 Hz @ +18 dB/oct
130 - 225 Hz @ $5.00 \text{ g}^2/\text{Hz}$
225 - 1000 Hz @ -12 dB/oct
1000 - 2000 Hz @ $0.015 \text{ g}^2/\text{Hz}$

Composite = $31.0 \text{ g}_{\text{rms}}$

Input to Fuel Supply Module OFI Pressure Sensor (Sheet 3 of 5)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 45 Hz @ 0.080 g^2 /Hz
45 - 100 Hz @ +15 dB/oct
100 - 150 Hz @ 5.00 g^2 /Hz
150 - 715 Hz @ -12 dB/oct
715 - 1300 Hz @ 0.010 g^2 /Hz
1300 - 1500 Hz @ +15 dB/oct
1500 - 2000 Hz @ 0.020 g^2 /Hz

Composite = 24.3 g_{rms}

Longitudinal Axis

20 - 90 Hz @ 0.060 g^2 /Hz
90 - 180 Hz @ +15 dB/oct
180 - 250 Hz @ 2.00 g^2 /Hz
250 - 800 Hz @ -9 dB/oct
800 - 2000 Hz @ 0.060 g^2 /Hz

Composite = 23.3 g_{rms}

Tangential Axis

20 - 60 Hz @ 0.050 g^2 /Hz
60 - 130 Hz @ +18 dB/oct
130 - 225 Hz @ 5.00 g^2 /Hz
225 - 1070 Hz @ -12 dB/oct
1070 - 2000 Hz @ 0.010 g^2 /Hz

Composite = 30.9 g_{rms}

Input to Fuel Supply Module OFI Pressure Sensor (Sheet 4 of 5)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0075 g^2/Hz
20 - 100 Hz @ +12 dB/oct
100 - 150 Hz @ 5.00 g^2/Hz
150 - 715 Hz @ -12 dB/oct
715 - 1150 Hz @ 0.010 g^2/Hz
1150 - 1500 Hz @ +15 dB/oct
1500 - 2000 Hz @ 0.040 g^2/Hz

Composite = 25.1 g_{rms}

Longitudinal Axis

20 Hz @ 0.00021 g^2/Hz
20 - 150 Hz @ +15 dB/oct
150 - 250 Hz @ 5.00 g^2/Hz
250 - 1100 Hz @ -9 dB/oct
1100 - 2000 Hz @ 0.060 g^2/Hz

Composite = 35.7 g_{rms}

Tangential Axis

20 Hz @ 0.00066 g^2/Hz
20 - 120 Hz @ +15 dB/oct
120 - 250 Hz @ 5.00 g^2/Hz
250 - 1180 Hz @ -12 dB/oct
1180 - 2000 Hz @ 0.010 g^2/Hz

Composite = 34.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

* Design Criteria Only

Input to Fuel Supply Module OFI Pressure Sensor (Sheet 5 of 5)

6. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to Components on the Hydraulic Power Supply Service Panels
And the Hydraulic Fluid Supply Pressure Transducer (Sheet 1 of 5)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.019 g^2/Hz
20 - 46 Hz @ +9 dB/oct
46 - 105 Hz @ 0.22 g^2/Hz
105 - 250 Hz @ +9 dB/oct
250 - 420 Hz @ 3.50 g^2/Hz
420 - 1200 Hz @ -9 dB/oct
1200 - 2000 Hz @ 0.16 g^2/Hz

Composite = 40.0 g_{rms}

Longitudinal Axis

20 Hz @ 0.0035 g^2/Hz
20 - 150 Hz @ +9 dB/oct
150 - 720 Hz @ 1.50 g^2/Hz
720 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.070 g^2/Hz

Composite = 37.2 g_{rms}

Tangential Axis

20 Hz @ 0.0075 g^2/Hz
20 - 150 Hz @ +9 dB/oct
150 - 640 Hz @ 1.50 g^2/Hz
640 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.048 g^2/Hz

Composite = 35.0 g_{rms}

Input to Components on the Hydraulic Power Supply Service Panels
And the Hydraulic Fluid Supply Pressure Transducer (Sheet 2 of 5)

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.024 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 0.15 g^2/Hz
100 - 250 Hz @ +12 dB/oct
250 - 500 Hz @ 6.00 g^2/Hz
500 - 1000 Hz @ -9 dB/oct
1000 - 2000 Hz @ 0.80 g^2/Hz

Composite = 61.3 g_{rms}

Longitudinal Axis

20 Hz @ 0.017 g^2/Hz
20 - 155 Hz @ +6 dB/oct
155 - 850 Hz @ 1.00 g^2/Hz
850 - 1200 Hz @ -12 dB/oct
1200 - 2000 Hz @ 0.25 g^2/Hz

Composite = 33.6 g_{rms}

Tangential Axis

20 Hz @ 0.028 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 80 Hz @ 0.070 g^2/Hz
80 - 160 Hz @ +12 dB/oct
160 - 800 Hz @ 1.20 g^2/Hz
800 - 1525 Hz @ -9 dB/oct
1525 - 2000 Hz @ 0.17 g^2/Hz

Composite = 35.1 g_{rms}

Input to Components on the Hydraulic Power Supply Service Panels
And the Hydraulic Fluid Supply Pressure Transducer (Sheet 3 of 5)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 100 Hz @ 0.25 g^2/Hz
100 - 225 Hz @ +12 dB/oct
225 - 500 Hz @ 6.00 g^2/Hz
500 - 1150 Hz @ -9 dB/oct
1150 - 2000 Hz @ 0.50 g^2/Hz

Composite = 59.9 g_{rms}

Longitudinal Axis

20 Hz @ 0.040 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 72 Hz @ 0.080 g^2/Hz
72 - 140 Hz @ +12 dB/oct
140 - 850 Hz @ 1.00 g^2/Hz
850 - 1200 Hz @ -12 dB/oct
1200 - 2000 Hz @ 0.24 g^2/Hz

Composite = 33.5 g_{rms}

Tangential Axis

20 Hz @ 0.053 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 85 Hz @ 0.080 g^2/Hz
85 - 165 Hz @ +12 dB/oct
165 - 800 Hz @ 1.10 g^2/Hz
800 - 1550 Hz @ -9 dB/oct
1550 - 2000 Hz @ 0.15 g^2/Hz

Composite = 33.6 g_{rms}

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Input to Components on the Hydraulic Power Supply Service Panels
and the Hydraulic Fluid Supply Pressure Transducer (Sheet 4 of 5)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.075 g^2 /Hz
20 - 46 Hz @ +9 dB/oct
46 - 105 Hz @ 0.90 g^2 /Hz
105 - 250 Hz @ +9 dB/oct
250 - 420 Hz @ 14.00 g^2 /Hz
420 - 1200 Hz @ -9 dB/oct
1200 - 2000 Hz @ 0.65 g^2 /Hz

Composite = 80.0 g_{rms}

Longitudinal Axis

20 Hz @ 0.014 g^2 /Hz
20 - 150 Hz @ +9 dB/oct
150 - 720 Hz @ 6.00 g^2 /Hz
720 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.28 g^2 /Hz

Composite = 74.4 g_{rms}

Tangential Axis

20 Hz @ 0.030 g^2 /Hz
20 - 150 Hz @ +9 dB/oct
150 - 640 Hz @ 6.00 g^2 /Hz
640 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.19 g^2 /Hz

Composite = 70.0 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

* Design Criteria Only

**Input to Components on the Hydraulic Power Supply Service Panels
and the Hydraulic Fluid Supply Pressure Transducer (Sheet 5 of 5)**

6. Shock Test Criteria (2 shocks/axis)

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to the SRB Actuator Assembly (Nozzle Attach) (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.0095 g^2/Hz
20 - 800 Hz @ +3 dB/oct
800 - 1200 Hz @ 0.38 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.14 g^2/Hz

Composite = 21.8 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 Hz @ 0.038 g^2/Hz
20 - 800 Hz @ +3 dB/oct
800 - 1200 Hz @ 1.50 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.55 g^2/Hz

Composite = 43.6 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0073 g^2/Hz
20 - 70 Hz @ +12 dB/oct
70 - 200 Hz @ 1.10 g^2/Hz
200 - 650 Hz @ -15 dB/oct
650 - 1400 Hz @ 0.0030 g^2/Hz
1400 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0015 g^2/Hz

Composite = 14.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.019 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 1400 Hz @ 0.12 g^2/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.041 g^2/Hz

Composite = 14.4 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

* Design Criteria Only

Input to the SRB Actuator Assembly (Nozzle Attach) (Sheet 2 of 2)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Nozzle Severance

50 Hz @ 938 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 3,750 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 150,000 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
2.3 G's peak Amplitude
300 msec Duration

Input to the SRB Actuator Assembly (Aft Skirt Attach) (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 37 Hz @ +6 dB/oct
37 - 225 Hz @ 0.045 g^2/Hz
225 - 385 Hz @ -9 dB/oct
385 - 800 Hz @ 0.0090 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0015 g^2/Hz

Composite = 4.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0038 g^2/Hz
20 - 57 Hz @ +6 dB/oct
57 - 800 Hz @ 0.030 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0048 g^2/Hz

Composite = 6.1 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.014 g^2/Hz
20 - 35 Hz @ +6 dB/oct
35 - 200 Hz @ 0.043 g^2/Hz
200 - 280 Hz @ -12 dB/oct
280 - 1200 Hz @ 0.010 g^2/Hz
1200 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0062 g^2/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 30 Hz @ +3 dB/oct
30 - 1000 Hz @ 0.024 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 6.3 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 200 Hz @ 0.068 g^2/Hz
200 - 360 Hz @ -12 dB/oct
360 - 1000 Hz @ 0.0068 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0034 g^2/Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.022 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0088 g^2/Hz

Composite = 5.8 g_{rms}

Input to the SRB Actuator Assembly (Aft Skirt Attach) (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.052 g^2/Hz
20 - 37 Hz @ +6 dB/oct
37 - 225 Hz @ 0.18 g^2/Hz
225 - 385 Hz @ -9 dB/oct
385 - 800 Hz @ 0.036 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 9.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.015 g^2/Hz
20 - 57 Hz @ +6 dB/oct
57 - 800 Hz @ 0.12 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.019 g^2/Hz

Composite = 12.2 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 2.0 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 3.7 G's peak

* Design Criteria Only

Input to the SRB Acutator Assembly (Aft Skirt Attach) (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

See Input to the SRB Actuator Assembly (Nozzle Attach)

B. Water Landing

Longitudinal Axis

Half Sine Pulse

30 G's peak Amplitude

150 msec Duration

Lateral Axes

Half Sine Pulse

27 G's peak Amplitude

100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse

3.1 G's peak Amplitude

300 msec Duration

Lateral Axes

Half Sine Pulse

2.3 G's peak Amplitude

300 msec Duration

Input to the DBM-54 Camera and Electronic Timer (Sheet 1 of 5)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.023 g^2/Hz
20 - 50 Hz @ +12 dB/oct
50 - 100 Hz @ 0.90 g^2/Hz
100 - 180 Hz @ -3 dB/oct
180 - 600 Hz @ 0.50 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0040 g^2/Hz

Composite = 20.3 g_{rms}

Longitudinal Axis

20 Hz @ 0.0050 g^2/Hz
20 - 140 Hz @ +3 dB/oct
140 - 600 Hz @ 0.035 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 5.3 g_{rms}

Tangential Axis

20 Hz @ 0.0075 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 90 Hz @ 0.12 g^2/Hz
90 - 216 Hz @ -12 dB/oct
216 - 1000 Hz @ 0.0035 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00088 g^2/Hz

Composite = 3.7 g_{rms}

Input to the DBM-54 Camera and Electronic Timer (Sheet 2 of 5)

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.013 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 85 Hz @ 0.20 g^2/Hz
85 - 140 Hz @ -3 dB/oct
140 - 600 Hz @ 0.12 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0010 g^2/Hz

Composite = 9.8 g_{rms}

Longitudinal Axis

20 Hz @ 0.0038 g^2/Hz
20 - 70 Hz @ +9 dB/oct
70 - 120 Hz @ 0.16 g^2/Hz
120 - 145 Hz @ -9 dB/oct
145 - 600 Hz @ 0.090 g^2/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0082 g^2/Hz

Composite = 9.6 g_{rms}

Tangential Axis

20 Hz @ 0.020 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 100 Hz @ 0.30 g^2/Hz
100 - 310 Hz @ -9 dB/oct
310 - 1000 Hz @ 0.0090 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0045 g^2/Hz

Composite = 6.7 g_{rms}

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Input to the DBM-54 Camera and Electronic Timer (Sheet 3 of 5)

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.016 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 600 Hz @ 0.25 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0021 g^2/Hz

Composite = 13.8 g_{rms}

Longitudinal Axis

20 Hz @ 0.0026 g^2/Hz
20 - 70 Hz @ +9 dB/oct
70 - 600 Hz @ 0.10 g^2/Hz
600 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0091 g^2/Hz

Composite = 9.8 g_{rms}

Tangential Axis

20 Hz @ 0.016 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 80 Hz @ 0.25 g^2/Hz
80 - 380 Hz @ -6 dB/oct
380 - 1000 Hz @ 0.010 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.0051 g^2/Hz

Composite = 6.3 g_{rms}

Input to the DBM-54 Camera and Electronic Timer (Sheet 4 of 5)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.093 g^2/Hz
20 - 50 Hz @ +12 dB/oct
50 - 100 Hz @ 3.60 g^2/Hz
100 - 180 Hz @ -3 dB/oct
180 - 600 Hz @ 2.00 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.016 g^2/Hz

Composite = 40.7 g_{rms}

Longitudinal Axis

20 Hz @ 0.020 g^2/Hz
20 - 140 Hz @ +3 dB/oct
140 - 600 Hz @ 0.14 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0038 g^2/Hz

Composite = 10.6 g_{rms}

Tangential Axis

20 Hz @ 0.030 g^2/Hz
20 - 50 Hz @ +9 dB/oct
50 - 90 Hz @ 0.46 g^2/Hz
90 - 216 Hz @ -12 dB/oct
216 - 1000 Hz @ 0.014 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0035 g^2/Hz

Composite = 7.4 g_{rms}

Input to the DBM-54 Camera and Electronic Timer (Sheet 5 of 5)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the Frustum Recovery Beacon (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 40 Hz @ 0.032 g^2 /Hz
40 - 50 Hz @ -6 dB/oct
50 - 600 Hz @ 0.021 g^2 /Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00058 g^2 /Hz

Composite = 4.3 g_{rms}

Long. and Tang. Axes

20 - 800 Hz @ 0.0082 g^2 /Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.00052 g^2 /Hz

Composite = 3.0 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.017 g^2 /Hz
20 - 28 Hz @ +3 dB/oct
28 - 800 Hz @ 0.023 g^2 /Hz
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00069 g^2 /Hz

Composite = 5.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.011 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 900 Hz @ 0.022 g^2 /Hz
900 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00090 g^2 /Hz

Composite = 5.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 120 Hz @ 0.012 g^2 /Hz
120 - 180 Hz @ +9 dB/oct
180 - 800 Hz @ 0.039 g^2 /Hz
800 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0010 g^2 /Hz

Composite = 6.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0028 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ 0.0051 g^2 /Hz
120 - 180 Hz @ +9 dB/oct
180 - 1100 Hz @ 0.020 g^2 /Hz
1100 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0023 g^2 /Hz

Composite = 5.0 g_{rms}

Input to the Frustum Recovery Beacon (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 40 Hz @ $0.13 \text{ g}^2/\text{Hz}$
40 - 50 Hz @ -6 dB/oct
50 - 600 Hz @ $0.085 \text{ g}^2/\text{Hz}$
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0023 \text{ g}^2/\text{Hz}$

Composite = $8.6 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 800 Hz @ $0.033 \text{ g}^2/\text{Hz}$
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ $0.0021 \text{ g}^2/\text{Hz}$

Composite = $6.1 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the Frustum Recovery Beacon (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 94 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 375 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 15,000 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
50 G's peak Amplitude
50 msec Duration

Lateral Axes

Half Sine Pulse
15 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
0.8 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
8.1 G's peak Amplitude
300 msec Duration

Input to the Forward Skirt Beacon Transmitter (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0032 g^2/Hz

Composite = 6.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 5.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 310 Hz @ 0.054 g^2/Hz
310 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.090 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.060 g^2/Hz
150 - 180 Hz @ -6 dB/oct
180 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 7.8 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.20 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.013 g^2/Hz

Composite = 13.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.080 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2/Hz

Composite = 10.8 g_{rms}

Input to the Forward Skirt Beacon Transmitter (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 200 Hz @ 0.25 g^2/Hz
200 - 260 Hz @ -6 dB/oct
260 - 600 Hz @ 0.15 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0041 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.30 g^2/Hz
150 - 235 Hz @ -12 dB/oct
235 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0080 g^2/Hz

Composite = 9.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the Forward Skirt Beacon Transmitter (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Rate Gyro (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0032 g^2/Hz

Composite = 6.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 5.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 310 Hz @ 0.054 g^2/Hz
310 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.090 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 9.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.060 g^2/Hz
150 - 180 Hz @ -6 dB/oct
180 - 1000 Hz @ 0.040 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.010 g^2/Hz

Composite = 7.8 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 800 Hz @ 0.20 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.013 g^2/Hz

Composite = 13.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 1000 Hz @ 0.080 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.020 g^2/Hz

Composite = 10.8 g_{rms}

Input to the Rate Gyro (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 200 Hz @ 0.25 g^2/Hz
200 - 258 Hz @ -6 dB/oct
258 - 600 Hz @ 0.15 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0041 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.30 g^2/Hz
150 - 235 Hz @ -12 dB/oct
235 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0080 g^2/Hz

Composite = 9.6 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the Rate Gyro (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Separation Motor DFI Pressure Sensor (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.0042 g^2/Hz
20 - 32 Hz @ +3 dB/oct
32 Hz @ 0.0065 g^2/Hz
32 - 55 Hz @ +6 dB/oct
55 - 200 Hz @ 0.019 g^2/Hz
200 - 315 Hz @ +9 dB/oct
315 - 1000 Hz @ 0.075 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.038 g^2/Hz

Composite = 10.5 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

20 Hz @ 0.017 g^2/Hz
20 - 32 Hz @ +3 dB/oct
32 Hz @ 0.026 g^2/Hz
32 - 55 Hz @ +6 dB/oct
55 - 200 Hz @ 0.077 g^2/Hz
200 - 315 Hz @ +9 dB/oct
315 - 1000 Hz @ 0.30 g^2/Hz
1000 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.15 g^2/Hz

Composite = 21.1 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

20 - 800 Hz @ 0.12 g^2/Hz
800 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.048 g^2/Hz

Composite = 13.5 g_{rms}

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

N/A

Input to the Separation Motor DFI Pressure Sensor (Sheet 2 of 2)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 24 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 94 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
50 G's peak Amplitude
50 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
8. G's peak Amplitude
300 msec Duration

* Design Criteria Only

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Input to Separation Instrumentation Package (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.0025 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 1000 Hz @ 0.050 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 8.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2/Hz
20 - 70 Hz @ +6 dB/oct
70 - 150 Hz @ 0.050 g^2/Hz
150 - 220 Hz @ -6 dB/oct
220 - 1500 Hz @ 0.022 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.012 g^2/Hz

Composite = 6.7 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.0072 g^2/Hz
20 - 150 Hz @ +3 dB/oct
150 - 310 Hz @ 0.054 g^2/Hz
310 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.090 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.014 g^2/Hz

Composite = 9.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2/Hz
20 - 70 Hz @ +6 dB/oct
70 - 150 Hz @ 0.15 g^2/Hz
150 - 370 Hz @ -6 dB/oct
370 - 1500 Hz @ 0.046 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.025 g^2/Hz

Composite = 10.1 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 Hz @ 0.010 g^2/Hz
20 - 400 Hz @ +3 dB/oct
400 - 1000 Hz @ 0.20 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.050 g^2/Hz

Composite = 16.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 70 Hz @ +6 dB/oct
70 - 150 Hz @ 0.20 g^2/Hz
150 - 220 Hz @ -6 dB/oct
220 - 1500 Hz @ 0.090 g^2/Hz
1500 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.050 g^2/Hz

Composite = 13.4 g_{rms}

Input to Separation Instrumentation Package (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 200 Hz @ 0.25 g^2/Hz
200 - 258 Hz @ -6 dB/oct
258 - 600 Hz @ 0.15 g^2/Hz
600 - 1028 Hz @ -9 dB/oct
1028 - 2000 Hz @ 0.030 g^2/Hz

Composite = 12.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.052 g^2/Hz
20 - 100 Hz @ +5 dB/oct
100 - 150 Hz @ 0.75 g^2/Hz
150 - 258 Hz @ -15 dB/oct
258 - 800 Hz @ 0.050 g^2/Hz
800 - 943 Hz @ -6 dB/oct
943 - 2000 Hz @ 0.036 g^2/Hz

Composite = 12.7 g_{rms}

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to Separation Instrumentation Package (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. ET/SRB Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

Input to the Barometric Altitude Switch (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 60 Hz @ 0.012 g^2/Hz
60 - 163 Hz @ +3 dB/oct
163 - 340 Hz @ 0.032 g^2/Hz
340 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.00095 g^2/Hz

Composite = 4.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.00070 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ 0.0014 g^2/Hz
120 - 200 Hz @ +9 dB/oct
200 - 1400 Hz @ 0.0075 g^2/Hz
1400 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0018 g^2/Hz

Composite = 3.4 g_{rms}

2. Lift-off Random Vibration Criteria (50 sec plus 10 sec/mission in each axis)

Radial Axis

20 Hz @ 0.017 g^2/Hz
20 - 50 Hz @ +3 dB/oct
50 - 700 Hz @ 0.040 g^2/Hz
700 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00069 g^2/Hz

Composite = 6.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.011 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 1400 Hz @ 0.022 g^2/Hz
1400 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0053 g^2/Hz

Composite = 6.0 g_{rms}

3. Boost Random Vibration Criteria (80 sec plus 40 sec/mission in each axis)

Radial Axis

20 - 120 Hz @ 0.0083 g^2/Hz
120 - 230 Hz @ +9 dB/oct
230 - 670 Hz @ 0.054 g^2/Hz
670 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.00069 g^2/Hz

Composite = 6.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0028 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 120 Hz @ 0.0056 g^2/Hz
120 - 200 Hz @ +9 dB/oct
200 - 1400 Hz @ 0.030 g^2/Hz
1400 - 2000 Hz @ -12 dB/oct
2000 Hz @ 0.0070 g^2/Hz

Composite = 6.9 g_{rms}

Input to the Barometric Altitude Switch (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 - 60 Hz @ $0.048 \text{ g}^2/\text{Hz}$
60 - 163 Hz @ +3 dB/oct
163 - 340 Hz @ $0.13 \text{ g}^2/\text{Hz}$
340 - 2000 Hz @ -6 dB/oct
2000 Hz @ $0.0038 \text{ g}^2/\text{Hz}$

Composite = $8.4 \text{ g}_{\text{rms}}$

Long. and Tang. Axes

20 - 1400 Hz @ $0.016 \text{ g}^2/\text{Hz}$
1400 - 2000 Hz @ -12 dB/oct
2000 Hz @ $0.0039 \text{ g}^2/\text{Hz}$

Composite = $5.2 \text{ g}_{\text{rms}}$

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 0.7 G's peak*
5 - 10 Hz @ 0.7 G's peak
10 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.5 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

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Input to the Barometric Altitude Switch (Sheet 3 of 3)

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing.

Longitudinal Axis

Half Sine Pulse
50 G's peak Amplitude
50 msec Duration

Lateral Axes

Half Sine Pulse
15 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
0.8 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
8.1 G's peak Amplitude
300 msec Duration

Input to the SRB Connectors* (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

20 Hz @ 0.75 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 1.50 g^2/Hz
60 - 73 Hz @ -6 dB/oct
73 - 97 Hz @ 1.00 g^2/Hz
97 - 120 Hz @ +12 dB/oct
120 - 200 Hz @ 2.28 g^2/Hz
200 - 235 Hz @ -15 dB/oct
235 --- 660 Hz @ 1.00 g^2/Hz
660 - 1050 Hz @ -9 dB/oct
1050 - 1400 Hz @ 0.25 g^2/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.082 g^2/Hz

Composite = 34.1 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

20 Hz @ 0.22 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 0.44 g^2/Hz
60 - 108 Hz @ +3 dB/oct
108 - 168 Hz @ 0.80 g^2/Hz
168 - 180 Hz @ +9 dB/oct
180 - 530 Hz @ 1.00 g^2/Hz
530 - 800 Hz @ +3 dB/oct
800 - 1200 Hz @ 1.50 g^2/Hz
1200 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.55 g^2/Hz

Composite = 46.0 g_{rms}

* These random vibration criteria represent an envelope of the applicable zonal criteria. These criteria are inputs to components having attached connectors; therefore, the test setups should include component dynamic simulations.

Input to the SRB Connectors (Sheet 2 of 3)

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

20 Hz @ 3.00 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 6.00 g^2/Hz
60 - 73 Hz @ -6 dB/oct
73 - 97 Hz @ 4.00 g^2/Hz
97 - 120 Hz @ +12 dB/oct
120 - 200 Hz @ 9.12 g^2/Hz
200 - 235 Hz @ -15 dB/oct
235 - 660 Hz @ 4.00 g^2/Hz
660 - 1050 Hz @ -9 dB/oct
1050 - 1400 Hz @ 1.00 g^2/Hz
1400 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.33 g^2/Hz

Composite = 68.3 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.6 G's peak
10 - 40 Hz @ 4.3 G's peak

* Design Criteria Only

Input to the SRB Connectors (Sheet 3 of 3)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Forward Skirt/Frustum Separation

50 Hz @ 188 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 750 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 30,000 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
50 G's peak Amplitude
50 msec Duration

Lateral Axes

Half Sine Pulse
27 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
500 msec Duration

Lateral Axes

Half Sine Pulse
8.1 G's peak Amplitude
300 msec Duration

Input to the SRM Safe and Arm Device (Sheet 1 of 2)

1. Acceptance Test Criteria (1 min/axis)

- 20 - 50 Hz @ 0.0050 g^2/Hz
- 50 - 150 Hz @ +3 dB/oct
- 150 - 500 Hz @ 0.015 g^2/Hz
- 500 - 2000 Hz @ -6 dB/oct
- 2000 Hz @ 0.00095 g^2/Hz

Composite = 3.4 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

- 20 - 50 Hz @ 0.020 g^2/Hz
- 50 - 150 Hz @ +3 dB/oct
- 150 - 500 Hz @ 0.060 g^2/Hz
- 500 - 2000 Hz @ -6 dB/oct
- 2000 Hz @ 0.0038 g^2/Hz

Composite = 6.9 g_{rms}

3. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

- 20 Hz @ 0.0030 g^2/Hz
- 20 - 200 Hz @ +3 dB/oct
- 200 - 650 Hz @ 0.030 g^2/Hz
- 650 - 2000 Hz @ -9 dB/oct
- 2000 Hz @ 0.0010 g^2/Hz

Composite = 5.0 g_{rms}

4. Vehicle Dynamics Criteria

Longitudinal Axis

- 3.5 - 5 Hz @ 1.0 G's peak*
- 5 - 40 Hz @ 1.0 G's peak

Lateral Axes

- 2 - 5 Hz @ 1.7 G's peak*
- 5 - 10 Hz @ 0.6 G's peak
- 10 - 40 Hz @ 1.7 G's peak

* Design Criteria Only

Input to the SRM Safe and Arm Device (Sheet 2 of 2)

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance Shock

No shock test required.

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

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APPENDIX C
VIBRATION AND SHOCK CRITERIA
FOR
SPECIFIC COMPONENTS
COMMON TO THE
SPACE SHUTTLE ET AND SRB

Input to the ET/SRB Range Safety Antenna (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.15 g^2 /Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 1.00 g^2 /Hz
100 - 160 Hz @ -9 dB/oct
160 - 315 Hz @ 0.25 g^2 /Hz
315 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 1.00 g^2 /Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.047 g^2 /Hz

Composite = 29.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.043 g^2 /Hz
20 - 40 Hz @ +6 dB/oct
40 - 315 Hz @ 0.17 g^2 /Hz
315 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.032 g^2 /Hz

Composite = 20.8 g_{rms}

2. Lift-off Random Vibration Criteria (250 sec/axis)

Radial Axis

20 Hz @ 0.010 g^2 /Hz
20 - 110 Hz @ +6 dB/oct
110 - 350 Hz @ 0.30 g^2 /Hz
350 - 500 Hz @ +10 dB/oct
500 - 800 Hz @ 1.00 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.16 g^2 /Hz

Composite = 30.6 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0026 g^2 /Hz
20 - 60 Hz @ +10 dB/oct
60 - 205 Hz @ 0.10 g^2 /Hz
205 - 350 Hz @ +9 dB/oct
350 - 800 Hz @ 0.50 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.082 g^2 /Hz

Composite = 22.8 g_{rms}

Input to the ET/SRB Range Safety Antenna (Sheet 2 of 3)

3. Boost Random Vibration Criteria (880 sec/axis)

Radial Axis

20 Hz @ 0.62 g^2/Hz
20 - 50 Hz @ +6 dB/oct
50 - 100 Hz @ 4.00 g^2/Hz
100 - 160 Hz @ -9 dB/oct
160 - 315 Hz @ 1.00 g^2/Hz
315 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 4.00 g^2/Hz
800 - 2000 Hz @ -10 dB/oct
2000 Hz @ 0.19 g^2/Hz

Composite = 58.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.18 g^2/Hz
20 - 40 Hz @ +6 dB/oct
40 - 315 Hz @ 0.70 g^2/Hz
315 - 450 Hz @ +9 dB/oct
450 - 800 Hz @ 2.00 g^2/Hz
800 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.13 g^2/Hz

Composite = 41.7 g_{rms}

4. Reentry Random Vibration Criteria (660 sec/axis)

Radial Axis

20 Hz @ 0.026 g^2/Hz
20 - 250 Hz @ +6 dB/oct
250 - 600 Hz @ 4.00 g^2/Hz
600 - 2000 Hz @ -12 dB/oct
2000 Hz @ .033 g^2/Hz

Composite = 50.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.080 g^2/Hz
150 - 225 Hz @ -9 dB/oct
225 - 1000 Hz @ 0.023 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0058 g^2/Hz

Composite = 6.4 g_{rms}

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Input to the ET/SRB Range Safety Antenna (Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.8 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 188 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 750 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 30,000 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the ET/SRB Range Safety Batteries (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.10 g^2 /Hz
20 - 100 Hz @ +6 dB/oct
100 - 170 Hz @ 0.25 g^2 /Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.022 g^2 /Hz

Composite = 11.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0040 g^2 /Hz
20 - 100 Hz @ +3 dB/oct
100 - 360 Hz @ 0.020 g^2 /Hz
360 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.055 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0087 g^2 /Hz

Composite = 7.3 g_{rms}

2. Lift-off Random Vibration Criteria (250 sec/axis)

Radial Axis

20 Hz @ 0.0072 g^2 /Hz
20 - 100 Hz @ +9 dB/oct
100 - 170 Hz @ 0.95 g^2 /Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.082 g^2 /Hz

Composite = 22.1 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.012 g^2 /Hz
20 - 100 Hz @ +3 dB/oct
100 - 240 Hz @ 0.060 g^2 /Hz
240 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.16 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.026 g^2 /Hz

Composite = 13.0 g_{rms}

3. Boost Random Vibration Criteria (880 sec/axis)

Radial Axis

20 Hz @ 0.042 g^2 /Hz
20 - 100 Hz @ +6 dB/oct
100 - 170 Hz @ 1.00 g^2 /Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.090 g^2 /Hz

Composite = 22.8 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.016 g^2 /Hz
20 - 100 Hz @ +3 dB/oct
100 - 360 Hz @ 0.080 g^2 /Hz
360 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.22 g^2 /Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.035 g^2 /Hz

Composite = 14.7 g_{rms}

Input to the ET/SRB Range Safety Batteries (Sheet 2 of 3)

4. Reentry Random Vibration Criteria (60 sec plus 30 sec/mission in each axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 200 Hz @ 0.25 g^2/Hz
200 - 260 Hz @ -6 dB/oct
260 - 600 Hz @ 0.15 g^2/Hz
600 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.0041 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.060 g^2/Hz
20 - 100 Hz @ +3 dB/oct
100 - 150 Hz @ 0.30 g^2/Hz
150 - 235 Hz @ -12 dB/oct
235 - 800 Hz @ 0.050 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0080 g^2/Hz

Composite = 9.6 g_{rms}

Input to the ET/SRB Range Safety Batteries (Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.8 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the ET/SRB Range Safety Couplers, Receiver and Decoder
(Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.050 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 64 Hz @ 0.10 g^2/Hz
 64 - 100 Hz @ +6 dB/oct
 100 - 170 Hz @ 0.25 g^2/Hz
 170 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.022 g^2/Hz

Composite = 11.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0087 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 105 Hz @ 0.017 g^2/Hz
 105 - 330 Hz @ +3 dB/oct
 330 - 950 Hz @ 0.055 g^2/Hz
 950 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.012 g^2/Hz

Composite = 8.4 g_{rms}

2. Lift-off Random Vibration Criteria (250 sec/axis)

Radial Axis

20 Hz @ 0.10 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 0.20 g^2/Hz
 60 - 100 Hz @ +9 dB/oct
 100 - 170 Hz @ 0.95 g^2/Hz
 170 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.082 g^2/Hz

Composite = 22.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.050 g^2/Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 315 Hz @ 0.10 g^2/Hz
 315 - 400 Hz @ +6 dB/oct
 400 - 800 Hz @ 0.16 g^2/Hz
 800 - 2000 Hz @ -6 dB/oct
 2000 Hz @ 0.026 g^2/Hz

Composite = 13.4 g_{rms}

Input to the ET/SRB Range Safety Couplers, Receiver and Decoder
(Sheet 2 of 3)

3. Boost Random Vibration Criteria (880 sec/axis)

Radial Axis

20 Hz @ 0.20 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 64 Hz @ 0.40 g^2/Hz
64 - 100 Hz @ +6 dB/oct
100 - 170 Hz @ 1.00 g^2/Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.090 g^2/Hz

Composite = 23.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.035 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 105 Hz @ 0.070 g^2/Hz
105 - 330 Hz @ +3 dB/oct
330 - 950 Hz @ 0.22 g^2/Hz
950 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.050 g^2/Hz

Composite = 16.8 g_{rms}

4. Reentry Random Vibration Criteria (660 sec/axis)

Radial Axis

20 Hz @ 0.38 g^2/Hz
20 - 70 Hz @ +3 dB/oct
70 - 90 Hz @ 1.20 g^2/Hz
90 - 115 Hz @ -12 dB/oct
115 - 250 Hz @ 0.44 g^2/Hz
250 - 550 Hz @ -12 dB/oct
550 - 1000 Hz @ 0.020 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0050 g^2/Hz

Composite = 13.0 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.54 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 50 Hz @ 0.90 g^2/Hz
50 - 80 Hz @ -12 dB/oct
80 - 450 Hz @ 0.15 g^2/Hz
450 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.034 g^2/Hz

Composite = 13.8 g_{rms}

Input to the ET/SRB Range Safety Couplers, Receiver and Decoder
(Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.8 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

Input to the ET/SRB Range Safety Safe and Arm Device
(Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.035 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 53 Hz @ 0.070 g^2/Hz
53 - 100 Hz @ +6 dB/oct
100 - 170 Hz @ 0.25 g^2/Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.022 g^2/Hz

Composite = 11.4 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.0070 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 95 Hz @ 0.014 g^2/Hz
95 - 250 Hz @ +3 dB/oct
250 - 440 Hz @ 0.037 g^2/Hz
440 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.055 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0087 g^2/Hz

Composite = 7.6 g_{rms}

2. Lift-off Random Vibration Criteria (250 sec/axis)

Radial Axis

20 Hz @ 0.075 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 54 Hz @ 0.15 g^2/Hz
54 - 100 Hz @ +9 dB/oct
100 - 170 Hz @ 0.95 g^2/Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.082 g^2/Hz

Composite = 22.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.040 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 280 Hz @ 0.080 g^2/Hz
280 - 400 Hz @ +6 dB/oct
400 - 800 Hz @ 0.16 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.026 g^2/Hz

Composite = 13.2 g_{rms}

Input to the ET/SRB Range Safety Safe and Arm Device
(Sheet 2 of 3)

3. Boost Random Vibration Criteria (880 sec/axis)

Radial Axis

20 Hz @ 0.14 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 53 Hz @ 0.28 g^2/Hz
53 - 100 Hz @ +6 dB/oct
100 - 170 Hz @ 1.00 g^2/Hz
170 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.090 g^2/Hz

Composite = 22.9 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.028 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 95 Hz @ 0.056 g^2/Hz
95 - 250 Hz @ +3 dB/oct
250 - 440 Hz @ 0.15 g^2/Hz
440 - 500 Hz @ +9 dB/oct
500 - 800 Hz @ 0.22 g^2/Hz
800 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.035 g^2/Hz

Composite = 15.2 g_{rms}

4. Reentry Random Vibration Criteria (660 sec/axis)

Radial Axis

20 Hz @ 0.50 g^2/Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 1.00 g^2/Hz
60 - 75 Hz @ -12 dB/oct
75 - 230 Hz @ 0.36 g^2/Hz
230 - 500 Hz @ -12 dB/oct
500 - 1000 Hz @ 0.017 g^2/Hz
1000 - 2000 Hz @ -6 dB/oct
2000 Hz @ 0.0042 g^2/Hz

Composite = 11.9 g_{rms}

Long. and Tang. Axes

20 - 40 Hz @ 0.75 g^2/Hz
40 - 60 Hz @ -12 dB/oct
60 - 400 Hz @ 0.13 g^2/Hz
400 - 2000 Hz @ -3 dB/oct
2000 Hz @ 0.026 g^2/Hz

Composite = 12.2 g_{rms}

Input to the ET/SPB Range Safety Safe and Arm Device
(Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 1.7 G's peak*
5 - 10 Hz @ 0.8 G's peak
10 - 40 Hz @ 1.7 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 12 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 47 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 1,875 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

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Input to the ET/SRB NSI Detonator (Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 Hz @ 0.050 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 0.10 g^2 /Hz
60 - 100 Hz @ +6 dB/oct
100 - 350 Hz @ 0.25 g^2 /Hz
350 - 600 Hz @ +6 dB/oct
600 - 1000 Hz @ 0.75 g^2 /Hz
1000 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 28.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.050 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 220 Hz @ 0.10 g^2 /Hz
220 - 600 Hz @ +6 dB/oct
600 - 1000 Hz @ 0.75 g^2 /Hz
1000 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.15 g^2 /Hz

Composite = 28.3 g_{rms}

2. Flight Random Vibration Criteria (4 min plus 2 min/mission in each axis)

Radial Axis

20 Hz @ 0.20 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 60 Hz @ 0.40 g^2 /Hz
60 - 100 Hz @ +6 dB/oct
100 - 350 Hz @ 1.00 g^2 /Hz
350 - 600 Hz @ +6 dB/oct
600 - 1000 Hz @ 3.00 g^2 /Hz
1000 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.60 g^2 /Hz

Composite = 57.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.20 g^2 /Hz
20 - 40 Hz @ +3 dB/oct
40 - 220 Hz @ 0.40 g^2 /Hz
220 - 600 Hz @ +6 dB/oct
600 - 1000 Hz @ 3.00 g^2 /Hz
1000 - 2000 Hz @ -7 dB/oct
2000 Hz @ 0.60 g^2 /Hz

Composite = 56.6 g_{rms}

Input to the ET/SRB NSI Detonator (Sheet 2 of 3)

3. Reentry Random Vibration Criteria (660 sec/axis)

Radial Axis

20 Hz @ 0.38 g^2/Hz
20 - 70 Hz @ +3 dB/oct
70 - 90 Hz @ 1.20 g^2/Hz
90 - 97 Hz @ -12 dB/oct
97 - 130 Hz @ 0.90 g^2/Hz
130 - 500 Hz @ +3 dB/oct
500 - 700 Hz @ 3.40 g^2/Hz
700 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.15 g^2/Hz

Composite = 51.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.54 g^2/Hz
20 - 34 Hz @ +3 dB/oct
34 - 50 Hz @ 0.90 g^2/Hz
50 - 54 Hz @ -12 dB/oct
54 - 70 Hz @ 0.70 g^2/Hz
70 - 120 Hz @ +3 dB/oct
120 - 1000 Hz @ 1.20 g^2/Hz
1000 - 2000 Hz @ -9 dB/oct
2000 Hz @ 0.15 g^2/Hz

Composite = 40.0 g_{rms}

Input to the FT/SRB NSI Detonator (Sheet 3 of 3)

4. Vehicle Dynamics Criteria

Longitudinal Axis

Lateral Axes

3.5 - 5 Hz @ 1.0 G's peak*

2 - 5 Hz @ 4.3 G's peak*

5 - 40 Hz @ 1.0 G's peak

5 - 10 Hz @ 0.8 G's peak

10 - 40 Hz @ 4.3 G's peak

5. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 24 G's peak

50 - 100 Hz @ +12 dB/oct

100 Hz @ 94 G's peak

100 - 4,000 Hz @ +6 dB/oct

4,000 - 10,000 Hz @ 3,750 G's peak

B. Water Landing

Longitudinal Axis

Lateral Axes

Half Sine Pulse

Half Sine Pulse

30 G's peak Amplitude

20 G's peak Amplitude

150 msec Duration

100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Lateral Axes

Half Sine Pulse

Half Sine Pulse

3.1 G's peak Amplitude

7.3 G's peak Amplitude

300 msec Duration

300 msec Duration

* Design Criteria Only

Input to the ET/SRB CDF Assembly and CDF Manifold
(Sheet 1 of 3)

1. Acceptance Test Criteria (1 min/axis)

Radial Axis

20 - 30 Hz @ 0.20 g^2 /Hz
 30 - 50 Hz @ +3 dB/oct
 50 - 200 Hz @ 0.32 g^2 /Hz
 200 - 500 Hz @ +3 dB/oct
 500 - 700 Hz @ 0.85 g^2 /Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.037 g^2 /Hz

Composite = 25.7 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.20 g^2 /Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 0.40 g^2 /Hz
 60 - 65 Hz @ -12 dB/oct
 65 - 1000 Hz @ 0.30 g^2 /Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.037 g^2 /Hz

Composite = 20.2 g_{rms}

2. Lift-off Random Vibration Criteria (250 sec/axis)

Radial Axis

20 Hz @ 0.050 g^2 /Hz
 20 - 34 Hz @ +6 dB/oct
 34 - 54 Hz @ 0.15 g^2 /Hz
 54 - 100 Hz @ +9 dB/oct
 100 - 170 Hz @ 0.95 g^2 /Hz
 170 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.082 g^2 /Hz

Composite = 22.2 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.056 g^2 /Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 340 Hz @ 0.14 g^2 /Hz
 340 - 400 Hz @ +6 dB/oct
 400 - 1200 Hz @ 0.19 g^2 /Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.11 g^2 /Hz

Composite = 17.9 g_{rms}

Input to the ET/SRB CDF Assembly and CDF Manifold
(Sheet 2 of 3)

3. Boost Random Vibration Criteria (880 sec/axis)

Radial Axis

20 - 25 Hz @ 0.12 g^2 /Hz
 25 - 36 Hz @ +6 dB/oct
 36 - 53 Hz @ 0.28 g^2 /Hz
 53 - 100 Hz @ +6 dB/oct
 100 - 170 Hz @ 1.00 g^2 /Hz
 170 - 240 Hz @ -3 dB/oct
 240 - 400 Hz @ 0.70 g^2 /Hz
 400 - 495 Hz @ -9 dB/oct
 495 - 800 Hz @ 0.38 g^2 /Hz
 800 - 2000 Hz @ -4 dB/oct
 2000 Hz @ 0.11 g^2 /Hz

Composite = 26.3 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.048 g^2 /Hz
 20 - 50 Hz @ +3 dB/oct
 50 - 75 Hz @ 0.12 g^2 /Hz
 75 - 100 Hz @ +3 dB/oct
 100 - 174 Hz @ 0.16 g^2 /Hz
 174 - 390 Hz @ +3 dB/oct
 390 - 1200 Hz @ 0.36 g^2 /Hz
 1200 - 2000 Hz @ -3 dB/oct
 2000 Hz @ 0.22 g^2 /Hz

Composite = 24.3 g_{rms}

4. Reentry Random Vibration Criteria (660 sec/axis)

Radial Axis

20 - 30 Hz @ 0.80 g^2 /Hz
 30 - 50 Hz @ +3 dB/oct
 50 - 200 Hz @ 1.30 g^2 /Hz
 200 - 500 Hz @ +3 dB/oct
 500 - 700 Hz @ 3.40 g^2 /Hz
 700 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g^2 /Hz

Composite = 51.5 g_{rms}

Long. and Tang. Axes

20 Hz @ 0.80 g^2 /Hz
 20 - 40 Hz @ +3 dB/oct
 40 - 60 Hz @ 1.60 g^2 /Hz
 60 - 65 Hz @ -12 dB/oct
 65 - 1000 Hz @ 1.20 g^2 /Hz
 1000 - 2000 Hz @ -9 dB/oct
 2000 Hz @ 0.15 g^2 /Hz

Composite = 40.5 g_{rms}

Input to the ET/SRB CDF Assembly and CDF Manifold
(Sheet 3 of 3)

5. Vehicle Dynamics Criteria

Longitudinal Axis

3.5 - 5 Hz @ 1.0 G's peak*
5 - 40 Hz @ 1.0 G's peak

Lateral Axes

2 - 5 Hz @ 4.3 G's peak*
5 - 10 Hz @ 0.8 G's peak
10 - 40 Hz @ 4.3 G's peak

6. Shock Test Criteria

Tests will be performed by applying two shocks per mission in each axis (one in each direction or equivalent) for a total of six shocks per mission by mechanical methods or one shock per mission by ordnance.

A. Ordnance

50 Hz @ 47 G's peak
50 - 100 Hz @ +12 dB/oct
100 Hz @ 188 G's peak
100 - 4,000 Hz @ +6 dB/oct
4,000 - 10,000 Hz @ 7,500 G's peak

B. Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's peak Amplitude
100 msec Duration

C. Parachute Deployment

Longitudinal Axis

Half Sine Pulse
3.1 G's peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
7.3 G's peak Amplitude
300 msec Duration

* Design Criteria Only

APPROVAL

PRELIMINARY VIBRATION, ACOUSTIC, AND SHOCK DESIGN AND TEST CRITERIA FOR COMPONENTS ON THE SRB, ET, AND SSME

BY

SYSTEMS DYNAMICS LABORATORY

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This document has also been reviewed and approved for technical accuracy.

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